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MEMOIR,
DESCRIPTIVE AND EXPLANATORY,
TO ACCOMPANY
THE NEW CHART
OF THE
ATLANTIC OCEAN:
AND COMPRISING
INSTRUCTIONS, GENERAL AND PARTICULAR,
FOR THE

Navigation of that Sea:

ALSO,

1. TABLES of the DETERMINED POSITIONS of all its principal Points, &c., from GREENLAND to the EQUATOR, with the Authorities; illustrated by Notes: including Remarks on the VARIATIONS of the COMPASS.
2. A COPIOUS EXPLANATION of the WINDS, TIDES, CURRENTS, &c.; and of the different PASSAGES over the Atlantic and Equator, as controlled by these Phenomena: including a General TIDE-TABLE.
3. DESCRIPTIONS of the COASTS and ISLANDS; particularly of AFRICA, and of the AZORES, MADRIDAS, CAPE VERDE, and BERMUDAS' ISLANDS.
4. A DESCRIPTION of ROCKS, SHOALS, and VIGIAS, or SUPPOSED DANGERS; with the Authorities on which they have been inserted in the Chart.

By **JOHN PURDY, HYDROGRAPHER.**

FIFTH EDITION; CORRECTED AND MATERIALLY IMPROVED:

INCLUDING, WITH NUMEROUS ADDITIONS, THOSE FORMERLY GIVEN FROM THE VOYAGES
OF COMMODORE KRUSENSTERN AND CAPTAIN LISIANSKY: OF CAPTAINS
M. FLINDERS, WM. H. SMYTH, AND BASIL HALL, R.N.;
AND OF THE BARON ALEX. DE HUMBOLDT; ALSO
FROM THE PAPERS OF MAJOR RENNELL,

AND FROM MANY ORIGINAL COMMUNICATIONS,

By CAPT. AND. LIVINGSTON, OF GLASGOW, CAPT. AB. BRISTOW, OTHER COMMANDERS
IN THE MERCHANT-SERVICE, AND SEVERAL OFFICERS IN THE ROYAL NAVY.

WITH AN APPENDIX:

Containing HINTS and REMARKS ON GENERAL NAUTICAL PRACTICE; viz. a Ship's
Reckoning; Latitude; Longitude; Chronometers; the Compass; Variation;
Temperature of the Sea; Mode of ascertaining Currents; Marine Ther-
mometer and Barometer; and the Subjects therewith connected.

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NOTICES OF SEVERAL NEW AND IMPORTANT LIGHT-HOUSES, ON DIFFERENT
POINTS, WILL BE FOUND INCLUDED, WITH OTHER ADDITIONS AND DESCRIPTIONS,
IN THE RESPECTIVE NOTES ON THE POSITIONS OF PLACES.

* * FOR ERRATA *and* ADDENDA *see* page 309.

[Entered at Stationers' Hall.]

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P 98

ADDRESS.

THIS work was first presented to the public, without preface or apology, in the year 1812; and we had, not long after, the pleasure of finding that a second edition was required. The latter appeared in 1814, and was enriched by the liberal communications of several respected friends. The third impression appeared in 1817, the fourth in 1821, and these were further improved by similar contributions, involving some important and valuable additions, with various facts and illustrations, collected from recent interesting works, as well as from some others of older date.

A comparison of the latter editions with those that preceded them, will shew how much we have been indebted to numerous friends for recent and important information. The copious and valuable communications of CAPTAIN LIVINGSTON, in particular, have displayed, at once, the intelligence of a scholar, the zeal of a patriot, and the skill of a seaman; while, in the mode of communication, he has shown all the kindness of a friend and the liberality of a gentleman. "Actuated," as he has said, and truly said, "by one motive only, the ambition of contributing his mite towards the service of his fellow-seamen."

To the subject of Currents, in particular, it will be found that our attention has been directed. These currents seem, at length, to have excited that inquiry into their nature and causes which the importance of the subject demands. It becomes us to acknowledge that the first view which we took of this subject originated from a perusal of the papers written by the learned and respected MAJOR RENNELL, from whom, we yet hope and trust, that a new and beautiful elucidation will emanate. It is gratifying to find that investigations have been recently

made, and that others are promised, which will add much to the information on currents already collected; so that we may expect, ultimately, a general and accurate view of all those which predominate on the Atlantic, in the respective seasons.

We enlarge the more especially upon the Currents, because, as now treated on, they are to seamen almost a **NEW SUBJECT**. To the majority it is, at least, one on which they particularly require information. If this position be doubted, consult the melancholy events produced by them, which are described in the present volume, and take into consideration the incomparable number of similar cases which must necessarily have escaped our notice; and of which many have been the indubitable effects of a confidence arising from ignorance and self-conceit.*

In presenting the *present Edition*, we have again to thank *Captain Livingston* for many additional favours; and our thanks are also especially due, for similar communications, to *John Mackellar, Esq.* now Rear-Admiral of the Blue, and to the Mercantile Captains *James Wallace Monteath*, of Liverpool, *John Wilson* and *Thomas Hamlin*, of Greenock, *Wm. J. Capes*, of the *Lady Macworth*, *James Steele Park*, of the *Carshalton-Park*, and *Thos. Wilson*, of the *Henry Wellesley*.

* The numerous wrecks that formerly occurred on the rocks and islands of Scilly, from ignorance of the tides and currents, are notorious. Add to these the wrecks, still more numerous, which have occurred on the coasts of Spain, Portugal, and Africa: upon which side of the ocean the currents have uniformly produced more mischief than on the opposite coasts. Among these were the British frigate *Apollo*, and about forty ships under her convoy, on the coast of Portugal, as described hereafter, page 95; of the vessel with *M. de Brisson*, in 1787, on the coast upon which, in 1810, the American ship *Charles* was wrecked, as noticed and described in our pages 97 and 158: of the *Montezuma*, page 98; of the brig *Commerce*, page 159; of the *Oswego*, 162; and *Medusa*, 163; about thirty other vessels lost on the African coast, of which, according to the respectable authority of *Mr. Jackson*, about seventeen were English, and five American, page 158; twenty-six others wrecked on the bar of Senegal, at different times, according to *M. Golberry*, page 168.

Many ships, also, have been lost, by the currents, &c. on *Alleganza*, *Graciosa*, and *Santa Clara*, of the *Canaries*, as noticed on page 213; the *Hartwell*, East-Indiaman, on the reefs of *Bonavista*, page 226; and, by similar causes, several others, on the *Roccas*, &c., off the *Brasilian* coast. See, with respect to those about *Newfoundland*, including the *Tweed*, the *Comus*, the *Harpooner*, the *Drake*, and the *Spence*, page 127.

To Lieut. *Chas. Hare*, R. N., we are indebted for the route described by him for ships bound to New Brunswick, &c. in the succeeding pages 142, 143. This route is so evidently and greatly advantageous, to every commander and merchant in that trade, as to demand particular notice.* To the friendship of Mr. *Wm. Heron*, of Greenock, we are also indebted for several matters of importance; among which will be found (page 127) some explanation of the current about the southern coast of Newfoundland; a current which, *while unknown*, has probably been the cause of so many wrecks on that coast.

In the Tables of Positions, many corrections have been made from the Observations and Surveys of the officers appointed to the surveying service by their Lordships of the Admiralty, as well as by other scientific men: and, in the descriptions of coasts, some additions have been made from the papers of an intelligent master, lately deceased, Mr. *James Finlaison*, and other correspondents.

The Directors of the *Deposito Hydrografico* of Madrid have done us the honour of translating for, and inserting into, the *Derrotero de las Antillas* all that we had heretofore collected on the subject of CURRENTS, and have superadded thereto some additional and valuable remarks which we have now incorporated in the present volume. On this subject, too, we have again been indebted to *Major Rennell* for the Remarks to be found on pages 99, 100. Numerous facts, illustrating the general set of currents, will be found described under their proper heads.

In the APPENDIX, also, will be found some further illustration of the same subject, with several additions on Magnetism and Chronometers, and a brief explanation of *Professor Barlow's* invaluable mode of counteracting the aberration of the compass, caused by the local attraction of the ship, &c.

* The celebrated timber-ship *Columbus*, on its return from London to America, foundered 17th May, 1825, in latitude 46° and longitude 29° , or about 130 leagues to the northward of the Azores, before Lieut. Hare's routes were known.

Our ardent wishes are, as our strenuous endeavours have been, devoted to the improvement of hydrography; and we, therefore, again, earnestly solicit communications for future correction, &c. Such communications are particularly acceptable, because ORIGINAL and AUTHENTIC; and, therefore, more to be depended upon than the imperfect statements commonly given in newspapers and other publications, as we have already had occasion to notice. The great importance of the latter has, however, been admitted; and we may here repeat the observation that, "A series of such notices, PROPERLY AUTHENTICATED, announcing the discovery and position of DANGERS, new determinations of the situations of places, &c. with the particulars of the observations, and names of the observers, would be very beneficial to the public service. Had such a measure been adopted years ago, many fine ships which, and brave sailors who, have been lost, might still have been in existence." We have urged this argument again and again, and still hope to see the suggestion adopted.

[*For the BEARINGS as given in the SAILING DIRECTIONS, see page 145.*]

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MEMOIR, &c.

SECTION I.

REMARKS *on the* CHART, *with* TABLES *of* DETERMINED POSITIONS, *and the* AUTHORITIES, &c. *including* NOTES *on the* VARIATION *of the* COMPASS.

THE accompanying Chart, which is, we believe, the only one that exhibits the WHOLE of the Atlantic Ocean, upon *so large a scale*, has been constructed with the particular view of superseding the general use of the Chart on four sheets, distinguished by the name of M. FLEURIEU, whose observations regulated many of its important points, but which was really constructed by the late M. DE LA ROCLETTE, and originally published in the house whence the present work issues, in the year 1777.

The merits of that Chart were universally admitted; of which, exclusive of a long continued and great demand for it, some degree of proof may arise, from its having been, during this period, more than once carelessly and coarsely copied, and illegally republished, without any attempt at amendment. Many defects in it have, however, been recently ascertained, by the observations of scientific men; and, as the plates have been several times re-engraved, and are again worn out, it has been deemed more eligible to construct a new one, founded on the present improved state of geography, and agreeable to the most recent observations, than to amend and repair that draught.

Upon the former Chart its respected compiler observed, that, "it is the third of the kind made public. The first having been published some years before at Amsterdam, in four sheets, by M. Vankeulen, under the title of the *Spanish or West-Indian Sea*; it contains some useful details, amidst a thousand errors: the second, entitled *A Chart of the Atlantic Ocean*, was engraven at London, on the circular projection, invented by the late Mr. Murdoch, but was found to be extremely inaccurate, and the constructor added to the Archipelago of Cape Verde, two islands, under the names of St. Philip and St. John, neither of which existed; these names being sometimes given by the Portuguese to the islands Fogo and Brava." M. Rochette adds, that, "in composing his Chart, he had many helps for the detail of the Coasts; and that they were corrected by the best astronomic observations."

As our present object is not to give a history of charts, we shall only add that, the determinations before made use of, which have been confirmed, have been strictly adhered to; and later observations have been carefully compared with those

those which have preceded them. The result of a general comparison has been, that many positions, *rejected* by the editors of the most authentic Tables of Positions, have been retained; while others, though subsequently given, have been merely taken into comparison; and a few, from their discordance, altogether rejected.

It is to the extended practice of lunar observations, and the use of chronometers, since the year 1768, that we owe our great improvements in modern Hydrography. The Geographer is happy in the consciousness of knowing that this scientific practice is now very generally understood, both in Europe and America. Chronometers in the hands of inexperienced persons have, however, been productive of some mischief; and may produce more, if not counteracted by vigilant attention and critical examination. Yet, while we contemplate this fact, it affords a pleasing reflection that, enough has already been done, in the more important tracts of the globe, to furnish the means of comparison, and thus prevent a retrogradation. It cannot, indeed, be supposed that all who practice these methods are equally skilful and experienced; or that, even if skilful and experienced, they can possess instruments equally correct. The most accurate observer, with an imperfect instrument, and the imperfect observer with an excellent instrument, obtain results equally erroneous. But such truths, with their consequences, are so obvious, that we hasten to the detail of authorities on which the Chart is grounded.

To the GRAND TRIGONOMETRIC SURVEY of England and Wales are owing the correct position of all the points in the Southern and South-western parts of the kingdom; and to that of FRANCE are, in like manner, owing the equally correct positions of all the points of that country. By Captain MARTIN WHITE, and other officers employed by the British Admiralty, the Great BANK of SOUNDINGS, and the general soundings of the ENGLISH CHANNEL, have recently been taken and correctly delineated; and they now form a most important and peculiar feature of the new charts. The coasts of SPAIN and PORTUGAL have been laid down in accordance with the valuable surveys of TOPINO, FRANZINI, &c.; and in the delineation of the AFRICAN COASTS, with the islands off the same, we have followed the positions afforded by MESSRS. FLEURIEU, VERDUN DE LA CRENNE, BORDA, and PINGRE', of France, with those of Sir GEORGE YOUNG, Captain BARTHOLOMEW, Lieutenants VIDAL and MUDGE, and many other intelligent officers of our own country.

The AMERICAN COASTS are exhibited according to the observations and surveys of our illustrious countryman Captain JAMES COOK, those of Lieut. MICHAEL LANE, of Mr. DES BARRES, and of Captain HOLLAND; the observations of MESSRS. WRIGHT, MASON, and DIXON, MESSRS. DE MAYNE, HOLBROOK, and BULLOCK, the British surveyors; Dr. RITTENHOUSE, Mr. ELLICOTT, and other astronomers, &c. of the United States.*

The given position of the BERMUDAS owes its origin to the late Captain THOMAS HURD, Hydrographer to the Admiralty, by whom these islands were surveyed, under the order of their Lordships.

* Since the appearance of the first edition of this work, the Editor has compiled the new Map of CABOTIA, which includes not only the British Canadian territory, but also a considerable portion of the United States. This has afforded him an opportunity of investigating more particularly those points which he had previously considered as doubtful. The results may be seen in the succeeding Tables.

Since the appearance of the second edition, we have been favoured with a manuscript Chart of the Northern Coasts of LABRADOR and UNGAVA BAY, as explored by the missionaries of the *Unitas Fratrum*, in 1811; and from which our Chart of the ATLANTIC, and of the WORLD, have been lately corrected; also with the positions of several important points in HUDSON'S BAY, &c., which are now given in our 'Memoir' on the Northern Ocean.

For the correct delineation of the WEST-INDIA ISLANDS, much has been derived from the labours of Messrs. PUYSEGUR, VERDUN, BORDA, PINGRE', and other foreign officers, whose observations and results have been subsequently corrected by the skilful observers acting under the orders of the Hydrographic Directors of Madrid; particularly the Captains JOAQUIN FR. FIDALGO, COSME' DE CHURRUCA, and JOSE' DEL RIO; to whom, and to Messrs. HUMBOLDT, OLTMANNS, &c. we are indebted for the numerous and accurate determinations of all the points of the SPANISH TERRITORIES in America. JAMAICA is exhibited according to the survey and observations of Mr. JOHN LEARD, and other officers, of the British Navy, and the details of the other islands according to the best topographic surveys and particular charts.

We may truly add, lastly, in the language of a preceding work, that every source has been exhausted to obtain means for rendering this Chart as exact as the present state of geography will permit; we, therefore, now proceed to give a detailed account of each determined point, to mention the authorities, and name the observers; in short, to report all that can inspire the navigator with the confidence which we think due to this work. This is done in honour to those who have made the observations; to encourage others to imitate them; and to establish the confidence of navigators in those parts of the Chart for which we have had sufficient materials, or to caution them against those which are not yet accurately known.

The Tables which follow exhibit the Positions of Points assumed in the construction of the Draught, illustrated by Notes. They will be found highly useful in furnishing the mariner, *satisfactorily*, with his required course and distance, to a precision unattainable by the mere use of *any* General Chart; and will, also, be found a useful accompaniment to every particular Chart of the Coasts of the Atlantic extant.

In the Tables, we quote, in general, the principal authorities only; it should therefore be understood, that many little corrections have been made on comparing these with other observations. Minute details are generally uninteresting; and this is the reason why every one is not described. In former Tables, many inaccuracies, amounting to 5, 6, and even to 15 and 20, minutes of longitude, have arisen from mere inadvertence; and many such errors exist, even to the present day, in our books of navigation, from an erroneous allowance for difference of meridians, as that of Ferro, &c., in those cases wherein the longitude has been originally given otherwise than from Greenwich. In some, the longitudes have been indiscriminately admitted from London and Greenwich, as one and the same; these therefore, abound in errors equal to the difference. We point out such particulars with the hope that those concerned will amend them, for the general advantage of the world. Science illumines the ocean with new means of safety, and the mist of ignorance must be exposed and dispelled.

It has been noticed, by more than one observer, that, when the position of a place is given, the *particular point* of it should always be *defined*, and that this point should be some object so fixed and conspicuous that it cannot be mistaken; as a castle, mole, or cathedral; many small differences having arisen from vaguely naming a town or bay. The importance of this hint will be most felt when chronometers are to be rated from a *given* longitude, and it, therefore, claims attention.

POSITIONS OF PLACES, &c.

1. ENGLAND AND WALES.

* * The FIGURES in Parentheses refer to the NOTES subjoined to each Section.

	LATITUDE.	LONGITUDE.	AUTHORITIES.
	° ' "	° ' "	
GREENWICH, ROYAL OBSERVATORY.....	51 28 40	0 0 0 *	The Astronomers Royal.
LONDON, cupola of St. Paul's Church.....	51 30 49	0 5 47 W.	The Grand Trigonometric or Ordnance Survey of England and Wales, commenced in the year 1784, by the late General Roy, F.R.S., under the direction of the Royal Society; subsequently under the orders of the Masters-general of the Ordnance; and now proceeding under the direction of Major Thos. Colby, of the Royal Engineers, F.R.S., &c.
Gravesend, church.....	51 27 39	0 22 10 E.	
Sheerness, flagstaff.....	51 26 45	0 44 26 —	
Orford, high lighthouse....	52 5 0	1 34 14 —	
North Foreland, lighthouse..	51 22 25	1 26 34 —	
South Foreland, high light-house.....	51 8 26	1 22 6 —	
Dover Castle (the keep)....	51 7 47	1 19 7 —	
Folkstone Church.....	51 4 47	1 10 52 —	
New Romney Church.....	50 59 7	0 56 22 —	
Lydd Church.....	50 57 7	0 54 19 —	
Dungeness Lighthouse.....	50 55 1	0 57 48 —	These operations, carried on in the most masterly and scientific manner, determine, with the similar triangles of France, hereafter noticed, the relative positions of all the points in the English Channel, &c.
Rye Church.....	50 57 1	0 44 0 —	
Beachy Head (Station in the Survey)	50 44 24	0 15 12 E.	
Brightelmstone Church...	50 49 32	0 7 40 W.	
Shoreham Church.....	50 50 0	0 16 19 —	
Selsey Church.....	50 45 19	0 45 41 —	
Chichester Spire.....	50 50 11	0 46 36 —	
Sea-Ower Light-vessel....	50 39 57	0 39 59 —	
Portsmouth Academy.....	50 48 4	1 5 59 —	
South-Sea Castle.....	50 46 44	1 5 2 —	
Calshot Castle.....	50 49 7	1 18 6 —	
Hurst Castle	50 42 25	1 32 45 —	
Dunnose (Station in the Survey)	50 37 9	1 11 36 —	
St. Catherine's Tower, Isle of Wight	50 35 34	1 17 51 —	
Needles' Lighthouse.....	50 39 54	1 33 55 —	
Christchurch Head	50 42 38	1 44 31 —	
Poole Church.....	50 42 51	1 58 55 —	
Portland Upper Lighthouse [1]	50 31 23	2 26 49 —	
Lyme Cobb.....	50 43 11	2 55 29 —	
Hob's or Bob's Nose.	50 27 50	3 26 43 —	
Berry Head, Flagstaff.....	50 24 2	3 28 14 —	
Start Point, Flagstaff.....	50 13 27	3 38 21 —	
Bolt Head (Signal Station)..	50 13 15	3 48 0 —	
Eddystone Lighthouse [2]..	50 10 56	4 15 3 —	
Mewstone, near Plymouth Sound.....	50 18 31	4 5 33 —	
Plymouth new Church	50 22 22	4 7 16 —	
Plymouth old Church.....	50 22 15	4 7 32 —	

ENGLAND AND WALES CONTINUED.

	LATITUDE.			LONG. W.			AUTHORITIES.
	°	'	"	°	'	"	
St. Nicholas' or Drake's Island, Plymouth Sound [3]	50	22	4	4	8	18	THE GRAND TRIGONOMETRIC OF ORDNANCE SURVEY of England, &c., described in the preceding page.
Penlee Beacon	50	19	25	4	10	40	
Rame Head (Flagstaff)	50	18	53	4	12	29	
Dodman or Deadman Point, Flagstaff	50	13	21	4	47	4	REMARKS. In the public journals of 1824, it was stated that Dr. THAKS had ascertained, in the summer of 1822, by the comparison of sixteen excellent chronometers, carried backward and forward between Greenwich and Falmouth, that the western longitude of the latter had been given at 4.4 seconds of time, or one minute and six seconds, too little, by the Trigonometric Survey. In consequence, twenty-nine of the best chronometers belonging to the Admiralty were subsequently committed to the care of the doctor, and a vessel was appointed wherein he was to sail, backward and forward, between Dover and Falmouth, until the longitude, in Time, between these stations, and between them and Portsmouth, as an intermediate station, was settled beyond any doubt. The result has been that, as to all places on the south coast of England, between the meridians of Greenwich and Falmouth, if one second be added to every four minutes of longitude, as given by the Survey, the exact longitude, according to the chronometers, will be obtained. By reference to Note 4, it will be seen that Dr. Bradley, in 1769, gave the Lizard Point rather more than a minute westward of the longitude assigned by the Trigonometric Survey: And, by Note 6, it is shown that the same result was obtained by Captain Huddart, in the longitude of St. Agnes', Scilly. Nevertheless, opinions vary on the subject. It will be sufficient for the mariner, if he assumes Pendennis Castle as 5° 2' W., the Lizard as 5° 12', St. Agnes' Lighthouse as 6° 20', &c.
St. Anthony's Head Flagstaff	50	8	35	4	59	31	
Pendennis Castle, Flagstaff	50	8	50	5	1	44	
St. Kivern's Steeple	50	3	7	5	4	8	
Blackhead, Flagstaff	50	1	13	5	3	59	
Lizard Upper Lighthouse [4]	49	57	41	5	11	5	
St. Michael's Mount	50	7	2	5	27	33	
St. Paul's Steeple, Mount's Bay [5]	50	5	26	5	31	37	
St. Leven's Point, Flagstaff	50	3	55	5	41	4	
Land's End Stone	50	4	8	5	41	31	
Longship's Lighthouse	50	4	2	5	43	33	
SCILLY ISLANDS.—St. Agnes' Lighthouse, revolving [6]	49	53	38	6	19	23	
St. Mary's Windmill	49	54	34	6	16	59	
St. Mary's, Flagstaff at the Fort	49	55	0	6	17	57	
St. Martin's Day-mark	49	58	4	6	14	39	
St. Agnes' Beacon, Cornwall	50	18	28	5	11	56	
Treose Head	50	32	58	5	0	54	
Hartland Point	51	1	23	4	30	26	
Lundy Island, Lighthouse [7]	51	10	5	4	39	20	
Bridgewater Spire	51	7	41	2	59	39	
Bristol Cathedral	51	27	6	2	35	29	
Worms Head	51	33	56	4	18	56	
Penbree Church	51	41	18	4	15	28	
St. Anne's High Lighthouse, entrance of Milford Haven	51	40	59	5	9	19	
Milford Church	51	42	43	5	0	39	
Hubberstone Church	51	42	56	5	2	7	
Small's Lighthouse [8]	51	43	18	5	38	54	
Grasholm	51	43	55	5	27	32	
Ramsey Isle (Highest Point)	51	51	43	5	19	36	
St. David's Cathedral	51	52	56	5	14	53	
Northern Rock of the Bishop and Clerks	51	54	10	5	21	58	

NOTES.

1. PORTLAND LIGHTHOUSES.—Under the direction of the Hon. Corporation of Trinity-House, in 1824, the lights here have been greatly improved. The high light, formerly fixed, is on the revolving principle, with three faces, each face exhibiting its greatest light every two minutes. The low light continues stationary, but its power and magnitude have been considerably increased.

2. EDDYSTONE LIGHTHOUSE.—Of the present lighthouse, on the rock called the Eddystone, one of the artificial wonders of England, the first stone was laid by Mr. John Smeaton, on the 12th of June, 1757, and the house was first lighted on the 16th of October, 1759. The height to the top of the lantern, exclusive of the cupola, is 92 feet from the sea, at low water of a spring-tide. The total height is 100 feet.

There are several reefs, or ridges of rock, in the vicinity of the Eddystone, or House Rock. Of these, the southern one extends to the distance of about 78 fathoms from the lighthouse. The East Rock lies at 65 fathoms eastward from the same, and the N.E. Rock, N. 60° E. true, at 150 fathoms.

The following particulars have been given by Mr. Smeaton. High water, at full and change, $V\frac{1}{4}h$. Rise of spring-tides, 16 to 18 feet: neaps, 10 to 11. Tide up Channel, from west to east, from half-flood to half-ebb; and runs down the Channel, from east to west, from half-ebb to half-flood. As the turn of the tide is not at high or low water, but three hours after each, the tide is here said to run tide and half-tide.

3. ST. NICHOLAS' OF DRAKE'S ISLAND.—Mr. Bayly, from his observations made in the observatory of Drake's Island, in 1772, concluded its latitude to be $50^{\circ} 21' 28''$; and the longitude, by means of the occultation of a star by the moon, compared with correspondent observations made at Greenwich, as $4^{\circ} 13' 30''$. See "*Observations made during the second and third voyages of Captain Cook*," by order of the Admiralty.

4. LIZARD POINT.—Dr. James Bradley, Astronomer Royal, from the mean between the results of several observations on the satellites of Jupiter, the passage of Venus over the sun in June, 1769, and an eclipse of the sun on the 4th of June, in the same year, deduced the latitude of the Lizard Point as $49^{\circ} 57' 30''$, and its longitude $5^{\circ} 13' 0''$.

5. ST. PAUL'S STEEPLE is given in the Requisite Tables, from the Ordnance Survey, as in $50^{\circ} 1' 24''$ N. and $5^{\circ} 21' 42''$ W., instead of the position since given, as in the present Table. The position will, also, be found corrected in the tabular statement of determined positions attached to the particular plans, in the collection of Harbours of the English Channel, &c., lately published by Mr. Laurie, and which exhibit other emendations. The collection of Harbour-charts here alluded to, with its companion, the General Chart of the Channel, indisputably constitute one of the finest, most accurate, and most useful, works of the kind that have ever appeared.

6. ST. AGNES' LIGHTHOUSE, SCILLY.—The observations made for determining the situation of St. Agnes' Lighthouse, at the commencement of the third voyage of Captain Cook, prove to be incorrect. It appeared, from these observations, to be in latitude $49^{\circ} 55'$, longitude $6^{\circ} 45'$. This error, of more than 25 minutes of longitude, has been very injurious, inasmuch as many charts have been subsequently regulated by the deduction. For, the Lizard Point having been previously determined by Dr. Bradley, these islands have, in consequence, been placed much too far from the Land's End. The fluctuation has, however, been completely set at rest by the Trigonometric Survey and the observations of JOSEPH HUDDART, Esq., F.R.S., &c. This gentleman, a few years since, visited the Scilly Islands, having with him a watch made by Arnold, and obtained his time at that spot where the body of Sir Cloudesley Shovel is said to have been thrown ashore, by means of equal altitudes of the sun's limb: he then found, comparing his time with that shown by the watch, that 0h. 25m. 18s. was the difference in time between the meridian of Greenwich and this spot in St. Mary's. Now, St. Agnes' Lighthouse is about 2 min. of a degree West of the place to which Captain Huddart alludes; therefore, $25' 18'' + 8'' = 25' 26''$ is the longitude of St. Agnes by these means; which differs only $4\frac{1}{2}$ seconds in time, or little more than one minute of longitude, from that found by the survey.—*Trig. Surv.* Vol. II. p. 135.

7. LUNDY ISLAND LIGHTHOUSE.—The lighthouse, situate on the S.W. side of Lundy Island, and first lighted 21st February, 1820, is a noble round tower. Its height, from the ground to the floor of the lantern, is 70 feet, and thence to the vane at the top, 19 feet. It exhibits *two distinct lights*: the upper revolving, without any interval of darkness, all round the circle: the lower one, 30 feet below the upper, faces the west, and exhibits a fixed and steady light over 90 degrees of the horizon only; or from N.N.W. to W.S.W. by compass. The land on which the lighthouse is erected is so high, that the upper light is 538 feet above the mean level of the sea: the lower light, 508 feet. The first may, therefore, be seen, in *clear weather*, at the distance of 26 miles, and the latter at 25 miles. There are eight lights in the upper, and four in the lower, lantern: but it has lately been noticed that, as the upper and lower lights are only thirty feet apart, at more than five miles from the island, to the westward, the whole appears *like one very strong revolving light*. This should be generally known; and, also, that, if there be any haze in the channel, the lights are mostly obscured; for, from the great elevation of the lights, it happens, at times, in moderately clear weather, that the island is visible when the lights cannot be seen.

8. **SMALLS, GRASHOLM, MILFORD HAVEN, &c.**—In the third Volume of the Account of the Trigonometric Survey, the longitude of Grasholm is stated to be $5^{\circ} 47' 1''$, and that of the Smalls' Lighthouse is printed $5^{\circ} 58' 34''$; but they are stated as in the Table, from a re-computation; obligingly communicated by Mr. J. Outhett. In the same volume, Milford Steeple is given as in $5^{\circ} 20' 13''$, instead of $5^{\circ} 0' 39''$ W.; and that of Hubberstone, as in $5^{\circ} 21' 47''$, instead of $5^{\circ} 2' 7''$ W. The station of CEFN BRYN is likewise given as in $4^{\circ} 56' 19''$, instead of $4^{\circ} 7' 25''$; the difference between it and Moel Rhyddlad having been added, instead of subtracted.

Pembree Steeple is also given, in the same way, as in $4^{\circ} 48' 16''$, instead of $4^{\circ} 15' 28''$ W. —See *Trig. Surv.* Vol. III. p. 380.

VARIATIONS OF THE COMPASS.—The Variation of the Compass, at London, according to the observations made in 1824, is $24^{\circ} 9\frac{1}{2}'$ W. In the Thames' Mouth it has been, for some years past, about $24\frac{1}{2}$ degrees: in the Downs it is rather less: when Mr. Spence made his Survey, 1795, it was only $22^{\circ} 50'$; but it increases to the westward. At Spithead, in 1813, it was nearly or rather less than 25° . At Portsmouth Observatory it was given, in the same year, as $24^{\circ} 15'$. At the Scilly Islands, in 1814, it was ascertained by Mr. Bain, and found to be nearly $27\frac{1}{2}^{\circ}$ W. This gentleman says, "In September, 1814, I determined the exact quantity of the variation at the Scilly Islands. The Sybille having continued two days at St Mary's, during that interval I went with an azimuth compass, artificial horizon, and sextant, to St. Agnes' Lighthouse, and there took *twelve* observations, the mean result of which gave $27^{\circ} 16'$ West variation. In the evening I went, with the same instruments, to St. Mary's Castle, and there ascertained the variation, by an excellent amplitude, to be $27^{\circ} 31'$ W. The mean is $27^{\circ} 23' 30''$ W." See, farther, the New Chart of the English Channel, &c.

2. COASTS OF IRELAND, &c.

	LATITUDE			LONG. W.			AUTHORITIES.
	°	'	"	°	'	"	
City of Dublin [1.]	53	21	30	6	17	0	Requisite Tables, &c. Dr. Ussher, Captain Joseph Huddart, &c.
Wicklow Pier	52	59	0	—	—	—	
City of Cork [2.]	51	53	54	8	30	0	Dr. Longfield.
Cape Clear [3.]	51	24	55	9	29	0	The Admiralty Surveyors, under the direction of Capt. Martin White, R.N., 1819.
Dursey Island [4.]	51	37	0	10	9	0	
Brandon Head	52	22	0	10	7	0	The Latitudes from the observations of Lieut. (since Captain) Shortland, R.N., 1801. The Longitudes deduced from that of Cape Clear.
Kerry Head	52	30	0	9	53	0	
Loop Head (Lighthouse) [5.]	52	37	0	9	52	0	
Tory Island, West-End [6.]	55	17	40	8	16	0	Captain Huddart's Chart.
Ennis-trahul or Insterahul } (Lighthouse) [7.] }	55	26	28	7	14	37	Mr. Lamont's Trigonometric Surveys.
Bengore Head [8.]	55	16	10	6	23	20	
Ballycastle	55	13	15	6	7	30	Deduced from Insterahul.
Fair Head	55	15	0	6	3	30	
Isle of St. Kilda [9.]	57	49	30	8	32	30	Captain Huddart's Chart.

NOTES.

1. **DUBLIN.**—The late Rev. Dr. Ussher, an excellent astronomer, F.R.S., and Professor of Astronomy in the University of Dublin, deduced, from the result of numerous observations, the latitude of his observatory, in Mecklenburgh Street, $53^{\circ} 21' 2''$, and its longitude 25 minutes of time, or $16^{\circ} 15'$ W. from Greenwich. In the last edition of the Requisite Tables, the position of Dublin is, however, given as $53^{\circ} 22' 0''$, and longitude $0^{\circ} 17' 0''$.

If we assume the longitude of the coasts of Wales, according to the Trigonometric Survey, and add to this the longitude thence to Dublin, according to the esteemed Chart by Captain Huddart, it will appear that the position given in the Requisite Tables is confirmed. The French Tables, entitled the *Connaissance des Temps* of 1803-4, have given the position of Dublin as $53^{\circ} 21' 11''$, and $6^{\circ} 16' 15''$; and, in later editions, the same latitude, with longitude $6^{\circ} 19' 0''$. The position above assigned, appears, therefore, to be sufficiently exact for all practical purposes.

2. CORK.—The position of Cork has been determined by good observations made by Dr. Longfield, originally communicated in the Philosophical Transactions of 1774, and again noticed by Dr. Beaufort, in his valuable "Memoir" relative to a Map of Ireland, 1792.

There is now a Lighthouse on Roche's Point, the eastern side of the entrance of Cork Harbour, which was first lighted 4th June, 1817. The light is steady, appearing, from seaward, of a deep red colour, but bright from the Cove, or Harbour.

3. CAPE CLEAR.—The position of Cape Clear appears, at length, to be satisfactorily ascertained. We had occasion to show, in our former editions, the uncertainty with regard both to the latitude and longitude of this important point; and it may still be proper to notice that the latitudes formerly given, by different observers, varied from $51^{\circ} 19'$ (that of Mackenzie and the Requisite Tables) to $51^{\circ} 28'$. The longitudes, in like manner, varied from $9^{\circ} 23'$ to $9^{\circ} 40'$. Admiral Knight, in 1800, when captain of the Montague, gave the latitude as $51^{\circ} 25'$, and the longitude as $9^{\circ} 30'$: this, it will be seen, varies only one minute, and that in longitude, from the result of the late observations; an instance of accuracy very honourable to its author.

The S.E. side of Clear Island is now distinguished by a Lighthouse, which was first illuminated on the 1st of May, 1818. The light is bright and revolving, attaining its greatest magnitude, or appearing quite full, once in every two minutes.

4. DURSEY ISLAND, &c.—It has been fully ascertained that the S.W. Coasts of Ireland have been laid down in the surveys of Mackenzie, &c. too far to the south. By a paper, printed for the Hydrographic Office at the Admiralty, in 1801, entitled, "Remarks on the S.W. and N.W. Coasts of Ireland, by Lieut. T. G. Shortland, of H. M. S. *Melpomene*," it appears, that, on making Dursey Island, off Bantry Bay, this gentleman observed with one of Ramsden's best sextants, and found the latitude of the S.W. end of it $51^{\circ} 37' N.$; and, being off there for three successive days, still found it the same; every quadrant in the ship, at the time, agreeing within a mile or two of his observation.

Sailing still on, past the Skelligs and Blasquets, next day, he observed off the mouth of the Shannon, and found Loop Head to be in $52^{\circ} 37'$ Kerry Head $52^{\circ} 30'$, and Brandon Head $52^{\circ} 22'$. Captain Shortland remarks, that he was off there five days, and had excellent observations: and it was inferred, that, the part of the coasts of Ireland, between Dursey Island and Urris Head, had been laid down from $10'$ to $12'$ to the southward of the truth. "The danger of which is, that, should a ship be running for the Shannon, and get a good observation, and run in the parallel of $52^{\circ} 24'$, or $52^{\circ} 26'$, and afterwards have thick weather, she would, instead of making the entrance of the Shannon, or Loop Head, run into Brandon or Tralee Bay; and, should it blow hard from the W.N.W., or West, so that she could not weather round Kerry Head, the consequence would be dreadful, from the heavy sea and foul ground in both these places.

"The same would hold good in running either for Bantry Bay or any other place on the S.W. and W. coast."

It appears that, from circumstances precisely as here described, the York, Indiaman, was lost in Tralee Bay, 29th October, 1758.

But, after all, there remains much uncertainty in regard to the S.W. points of Ireland. The Outer Skellig is placed in the Admiralty chart in longitude $10^{\circ} 34'$, while we have observations which bring it within $10^{\circ} 20'$. There are similar differences in regard to latitude: $51^{\circ} 46'$ to $51^{\circ} 55'$. Captain Jn. Wilson, of Greenock, by his observations, places the Foze Rock in $52^{\circ} 2' 52'' N.$ The charts have it in from $52^{\circ} 1'$ to $52^{\circ} 9' N.$

5. LOOP HEAD AND ARRAN ISLAND.—The Lighthouse on Loop Head exhibits a steady or fixed light, and is thus distinguished from the light near Cape Clear and that on Arran Island, both of which were first lighted on the same evening, in 1818. The lighthouse on Arran Island stands on the highest part, and may therefore be seen from every point. The light is revolving, of a bright colour, and attains its greatest magnitude once in every three minutes.

6. **GALWAY, TORY ISLAND, &c.**—The latitude of Galway is given in Dr. Beaufort's Memoir, as $53^{\circ} 16'$; but we presume that this must be about $1'$ or $2'$ south of its true situation. Tory Island is given, as stated, from Captain Huddart's Chart of the Western Isles, &c., but it does not appear that the Captain made particular observations on this point.

7. **ENNIS-TRAHUL.**—This island is now distinguished by a lighthouse, with revolving machinery, which is lighted every night, and presents its brightest light every two minutes. Its position has been communicated by Mr. Lamont, of Greenock, by whom it has been determined. It is not generally known that this gentleman employed himself, occasionally, for many years past, in prosecuting an extensive survey of the west of Scotland. In 1813, his triangular series had extended to the northern coast of Ireland; and it is to this that we allude in the Table.

On Fannet Point, the western side of the entrance of Lough Swilly, there is also a Lighthouse, which was first lighted 17th March, 1817. The light is steady; appearing, from seaward, of a deep red colour, but bright from the Lough or Harbour.

8. **BENGORE HEAD and BALLYCASTLE.**—The positions are deduced, per Chart, from Ennis-trahul, as communicated by Mr. Lamont. In Dr. Beaufort's Memoir, Bengore Head is given as in $55^{\circ} 15'$, and Ballycastle as in $55^{\circ} 12'$, from the observations of the Rev. W. Hamilton. Captain Livingston, from particular observations made by him, on passing, says, that Fair Head does not lie more to the northward than $55^{\circ} 14'$. Hence it seems that our latitudes of Bengore Head, &c. as given in the Table, may be rather too far to the North.

The Book of Directions, lately published by Mr. Laurie, to accompany the NEW CHART of ST. GEORGE'S CHANNEL, with all the COASTS of IRELAND, contains a particular description of Bengore Head, and of that stupendous curiosity, the GIANT'S CAUSEY, forming the western side of it. The mariner should know that these huge columns of basalt abound in ferruginous matter, which, on a near approach, derange the compass in all directions. FAIR HEAD, to the eastward, is similarly constructed; and among the innumerable basaltic columns at this celebrated promontory, is a quadrangular prism, 33 feet by 36, on the respective sides, and upwards of 200 feet in height. This column is supposed to be of the largest dimensions of any single shaft in the world. The depth of water near the cape is such, that vessels of considerable burthen can ride within a cable's length of it.

It may here be sufficient to add, that, for the western coasts and Islands of Scotland, we have made use of the survey by Capt. Huddart, a chart exhibiting the data on which it has been composed; for St. George's Channel, the survey, also of the same gentleman; and, for the North Sea, the chart constructed by the Editor of the present work.

Captain Huddart's Survey of the Hebrides, &c., was carried on, as he has stated, from observations made at Campbell-town, Tobermorey, Cana, Ullapool, Laxford, Stornoway, Glash, Namaddy, and Barra, to determine the latitude and longitude by astronomical instruments and chronometers; from which a series of triangles, determined from the true meridian, was carried on, to find the situation of the intermediate places, &c. Upon this subject Mr. Lamont has said, "As to the consistence of Captain Huddart's results in latitude, and my humble attempts, nothing ever afforded me more genuine satisfaction than the almost incredible coincidence of two observers, at distant periods, total strangers to each other: inasmuch that, of the 10 or 11 different positions which he settled in Scotland, and which are included in very nearly 500 that I have observed, none differ equal to the breadth of the lines usually drawn on maps or charts." We are sorry that the plan and limits of this work will not admit the detail; we hope, however, to see it in a form more honourable and advantageous to its respected author.

9. **ST. KILDA.**—In July, 1806, Mr. Lamont, jun. surveyed the islands of St. Kilda, Borera, &c. His results agree very well with Captain Huddart's. A general southerly current prevailed during the whole 20 or 21 days he remained on and about the islands; and is known to prevail during summer. St. Kilda is said to be visible from the hills of Skye, in very clear weather.

VARIATIONS OF THE COMPASS.—In Dublin Bay, the late Admiral Bligh found the variation to be $26^{\circ} 48'$ in December, 1800. On the South of Ireland, near Cork, it was found, at the same period, to exceed 28 degrees: and, on the North of Ireland, about 29 degrees. Off the North of Ireland, at six p. m. 31st July, 1820, (*ship's head N.W. by comp.*) Capt. Livingston found it $31^{\circ} 40'$. In Sept. 1822, Captain Wilson, of Greenock, off the west of Ireland, between $52^{\circ} 10'$ and $55^{\circ} 20'$, made it more than 32° .

At St. Kilda, in July, 1806, Mr. Lamont, jun. found it to be $31\frac{1}{2}^{\circ}$ W.; and near Cape Rath, or Wrath, in 1819, it was 30° W. Near the high rock, named Rokol, in latitude $57^{\circ} 39\frac{1}{2}'$, long. $13^{\circ} 31'$, the variation, in 1810, was about 33 degrees.

3. FRANCE, &c.

	LATITUDE.			LONGITUDE.			AUTHORITIES.
	°	'	"	°	'	"	
PARIS, <i>Royal Observatory</i> [1].....	48	50	14	2	20	0 E.	From the triangles intended, originally, merely for the admeasurement of the degrees of the meridian in France, but ultimately carried on throughout the kingdom. These were commenced by M. Picard, who effected an admeasurement between Paris and Amiens in 1699, and finally completed by Messrs. Mechain and Delambre, in 1798; after having exercised the abilities and industry of M. Cassini the elder, his son, and grandson; and of M. M. Maraldi and De la Caille, with other of the most eminent French astronomers, &c.
Antwerp, or Anvers [2]	51	13	16	4	23	55 —	
Vlissingen, or Flushing	51	26	42	3	34	42 —	
Ostende.....	51	13	57	2	54	53 —	
Nienport.....	51	7	54	2	45	0 —	
Dunkirk (Dunkerque).....	51	2	10	2	22	23 —	
Calais	50	57	32	1	51	1 —	
Boulogne	50	43	37	1	36	44 —	
Dieppe	49	55	34	1	4	29 —	
Le Havre	49	29	14	0	6	23 —	
Cape la Heve, Lighthouse.....	49	30	42	0	3	59 —	
Cape Barfleur, Lighthouse	49	41	15	1	16	15 W.	
Cherbourg	49	38	31	1	37	18 —	
Cape Frehel, Lighthouse	48	41	10	2	18	51 —	
USHANT (<i>Ouessant</i>) Lighthouse [3]	48	28	8	5	3	21 —	
Brest (At the Prefecture).....	48	22	43	4	29	0 —	
L'Orient	47	45	11	3	21	17 —	
Belle Isle, Pt. Locmaria	47	17	17	3	5	0 —	
Noirmoutier I.	47	0	5	2	14	22 —	
Nantes	47	13	6	1	32	59 —	
Isle d'Yeu (W. Pt.).....	46	42	26	2	19	50 —	
Rhe or Re Island, Lighthouse ...	46	14	49	1	33	40 —	
Oleron, Tour de Chassiron, Light.	46	2	51	1	24	27 —	
La Rochelle	46	9	21	1	9	2 —	
Rochefort	45	56	10	0	57	49 —	
Cordouan Lighthouse [4].....	45	35	15	1	10	38 —	
Bordeaux	44	50	14	0	34	14 —	
Bayonne	43	29	15	1	28	41 —	

[5]

NOTES.

1. PARIS.—The grand operations, in point of accuracy, for the determination of the length of the degrees of the meridian, have taken place since 1783. In that year a memorial was transmitted by M. Cassini de Thury to the Right Hon. Charles James Fox, then Secretary of State, showing the advantages that astronomy would derive from the construction of a series of triangles, that should connect, trigonometrically, the observatories of Greenwich and Paris, and thus correctly determine their relative positions.

This application caused the operations by General Roy, already explained, which have since extended into a General Survey. This gentleman, in England, acted in conjunction with Messrs. Cassini, Mechain, and Legendre, in France: but, it unfortunately happens that the results of the two parties do not exactly agree. That of the British officers being, for the difference of longitude, $2^{\circ} 19' 51''$, while that of the French is $2^{\circ} 20' 15''$. We have therefore stated it, after Dr. Maskelyne, as $2^{\circ} 20'$; and have assumed this as the difference of the meridians, whenever we have given the longitude from French observations.

2. ANTWERP.—Mr. Pinkerton, in the first page of his "Memoir on the State of Geography," observes, "It is said that, in successive editions of the *Necessary Tables*, *Anvers* was put under one latitude and longitude, and *Antwerp* under another." The table referred to, (in the *Requisite Tables*,) exhibited a difference in longitude only, and that a small one, which has been altered in the last or third edition. It is rather singular

gular that this identical error should exist in the table in Mr. Pinkerton's own book; wherein, also, Genoa and Genes are stated as two places in different longitudes. The position of Antwerp, as given in the Table, is that furnished by the French surveyors.

3. It was stated, a few years ago, that, from the chronometric observations of an ingenious and scientific officer, Ushant appeared to be in longitude $1^{\circ} 44' 15''$ W. from Torbay, or $5^{\circ} 13' 15''$ W. from Greenwich. This is certainly incorrect.

4. The TOWER or LIGHTHOUSE of CORDOUAN, at the mouth of the Gironde, is the most elegant structure of the kind existing. It was the work of Louis de Foix, a French architect, was twenty-six years in building, and completed in the reign of Henry IV., 1611. Its original height was 169 French feet; but, in 1727, the upper part being calcined, an iron lantern was erected, which increased its height. When lighted with coal, it consumed 225 pounds every night; but the light is now from lamps, with reflectors, on the new principle, revolving, and of great brilliancy. This light appears in its full lustre for 30 seconds, then diminishes for 30 seconds, to which succeeds a total eclipse for the same period, whence it again appears and increases to its full lustre. The light may be seen, from a boat, at the distance of 20 miles. See, farther, the Book of Directions, for the Bay of Biscay, &c., published by Mr. Laurie.

5. GENERAL NOTE.—Some emendations from re-computation have lately been made. Our positions are therefore given according to the *Connaissance des Temps*, &c. See, farther, the large Chart of the English Channel, published by Mr. Laurie, with additions, &c. 1824.

VARIATIONS OF THE COMPASS.—The Variation at the Isle of Ushant is, at present, about $25^{\circ} 30'$ W. The following were accurately ascertained by Captain W. H. Smyth, in 1810: Off L'Orient, $25^{\circ} 27\frac{1}{2}'$; at Anero, in the Glenans, $25^{\circ} 34'$; at Penfret, in the same, $25^{\circ} 32'$; at Groais, $25^{\circ} 28'$; at Belle Isle, $25^{\circ} 26'$; in Quiberon Bay, $25^{\circ} 30'$; and at Les Sables d'Olonne, $25^{\circ} 49'$.—The same officer found the variation off the bay, in latitude $46^{\circ} 28'$, and longitude $10^{\circ} 30'$, to be 24° degrees West, in 1804. For some remarks on Basque Roads, &c., by Captain Smyth, see Section III. hereafter.

4. SPAIN AND PORTUGAL.

	LATITUDE.			LONG. W.			AUTHORITIES.
	°	'	"	°	'	"	
MADRID, Grand Place [1]..	40	24	57	3	42	0	These Positions of Places in Spain and Portugal are given on the authority of Don VINCENTE TOFINO, and Don JOSEF VARELA, of the Spanish Marine, and of Major Franzini, of the Portuguese Royal Engineers; whose valuable charts and observations have been made use of in the delineation of the coasts. It is, nevertheless, to be noticed, that we have, both in this Table and in the Chart, adopted some subsequent emendations received through the medium of the <i>Connaissance des Temps</i> , &c.
Fontarabia.....	43	21	36	1	47	30	
Cape Machichaco.....	43	28	0	2	40	3	
Portugalete	43	20	10	2	58	35	
Santander	43	28	20	3	40	5	
Cape Penas or Pinas (Islet) ..	43	42	16	5	46	48	
Ribadeo, Entrance of the Harbour	43	34	45	6	59	45	
Vivero, Entr. of the Harbour..	43	43	45	7	32	45	
Point de la Estaca	43	47	50	7	38	50	
Cape Ortegal	43	46	40	7	50	30	
Cape Prior	43	34	15	8	12	45	
Ferrol, Entr. of the Harbour..	43	28	0	8	15	15	
Corunna, Lighthouse	43	23	36	8	19	35	
Cisargas Isles, off Cape St. Adrian	43	22	15	8	47	30	
Cape Villano	43	11	20	9	10	20	
Cape Tariana	43	3	0	9	17	0	
CAPE FINISTERRE.....	42	54	0	9	16	15	
Vigo.....	42	13	20	8	39	45	
Caminha, at the Entrance of the Minho	41	52	42	8	44	30	
Villa do Conde	41	21	20	8	37	42	
Porto or Oporto, the Bar of *..	41	10	15	8	38	0	
Aveiro, the Bar of	40	38	18	8	39	0	
Cape Mondego*	40	12	30	8	54	23	

SPAIN AND PORTUGAL CONTINUED.

	LATITUDE.			LONGITUDE.			AUTHORITIES.	
	°	'	"	°	'	"		
Berlengas or Borlings (<i>Mid. of the greatest</i>).....	39	24	40	9	31	11 W.	The observations of Don VINCENTE TOFINO, &c.	
Peniche, or Cape Carboeiro	39	21	20	9	24	0 —		
Cape Roca, or Rock of Lisbon*	38	46	30	9	26	56 —		
LISBON, OBSERVATORY [2]	38	42	18	9	7	48 —	REMARKS. Since the publication of our first Edition, we have been favoured by Capt. William Henry Smyth, of the Royal Navy, with a series of determined points, previously given by Tofino, &c., as shown in the Table. They were settled by this gentleman, when a lieutenant, in 1811 and 1812, by lunar and chronometric observations. We prefer giving both, because it affords a mean of estimating the respective value of each. The points given by Capt. Smyth, distinguished by asterisks (*) in the Table, are as follow: Oporto, 41° 10' 30" N., 8° 37' 18" W.: Cape Mondego, 40° 13' 30" N., 8° 52' 45" W.: Cape Roca, 38° 46' 15" N., 9° 25' 10" W.: Lisbon, 38° 42' 35" N., 9° 5' 50" W.: Cape Espichel, 38° 25' 30" N., 9° 10' 0" W.: Cape St. Vincent, 37° 2' 10" N., 9° 1' 10" W.: Lagos, 37° 8' 40" N., 8° 37' 45" W.: Cape St. Mary, 36° 57' 0" N., 7° 54' 30" W.: Chipiona, 36° 43' 50" N., 6° 24' 30" W.: Cadiz, 36° 32' 28" N., 6° 17' 30" W.: St. Sebastian Light, 36° 31' 10" N., 6° 18' 50" W.: Tariffa, 36° 0' 50" N., 5° 36' 15" W. <i>Within the Strait.</i> —Gibraltar, 36° 6' 30" N., 5° 21' 12" W.: Malaga, 36° 43' 15" N., 4° 25' 0" W.: Almeria, 36° 51' 56" N., 2° 31' 30" W.: Cartagena, 37° 36' 0" N., 1° 1' 20" W.: Cape Palos, 37° 36' 25" N., 0° 42' 55" W.: Valencia, 39° 27' 10" N., 0° 22' 25" W.: Alicante, 38° 19' 20" N., 0° 28' 56" E.: Montjui, 41° 23' 57" N., 2° 9' 40" E.	
Cape Espichel or Spichel..	38	24	54	9	12	0 —		
Bar of Odemira	37	39	0	8	49	0 —		
Cape St. Vincent*	37	2	54	9	0	54 —		
Lagos*	37	8	0	8	37	45 —		
Cape Santa Maria, or St. Mary*	36	56	24	7	49	50 —		
Monte Figo (<i>Acig. 4</i> 2000 ft.)	37	4	30	7	44	30 —		
Point Cidiona,* Entrance to St. Lucar.....	36	44	18	6	24	15 —		
CADIZ, OBSERVATORY*	36	32	0	6	17	37 —		
St. Sebastian Lighthouse..	36	31	10	6	18	50 —		
Cape Trafalgar.....	36	10	15	6	1	30 —		
Isle of Tariffa,* Lighthouse	36	0	50	5	36	15 —		
WITHIN THE STRAIT.								
GIBRALTAR—Europa Pt.* [3]	36	6	30	5	19	46 —		
Alboran, Low Island of....	35	56	30	3	0	55 —		
Malaga,* Lighthouse [4] ..	36	43	30	4	24	15 —		
Cape Sacrat.....	36	41	0	3	27	15 —		
Almeria*	36	51	0	2	31	15 —		
Cape de Gata	36	44	0	2	13	5 —		
Cartagena (<i>Cartagena</i>)* ..	37	35	50	1	0	15 —		
Cape de Palos*	37	37	15	0	41	15 —		
Alicante*	38	20	41	0	28	50 —		
Cape de la Nao	38	44	40	0	10	55 E.		
Cape St. Antonio	38	49	50	0	9	15 E.		
Cape Cullera.....	39	9	0	0	10	55 W.		
VALENCIA (Entr. to)	39	26	0	0	17	30 W.		
Cape Oropeza.....	40	5	33	0	8	10 E.		
Cape Tortosa	40	43	55	0	56	18 —		
Balaguer	40	59	30	0	59	0 —		
Tarragona	41	8	50	1	19	15 —		
Barcelona, Tower of Montjui*	41	21	45	2	9	48 —		
Fort Mongat.....	41	27	50	2	16	30 —		
Palamos.....	41	51	10	3	4	45 —		
Cape de Creux.....	42	19	35	3	16	15 —		
Port Mahon, Minorca, (<i>Cape Mola or the Mole Pt.</i>) [5]	39	51	10	4	25	13 —		
Cape Formenton, Majorca..	39	57	15	3	18	15 —		
Cape de Pera, ditto	39	42	12	3	31	25 —		
Palma, or Town of Mallorca	39	34	4	2	49	0 —		
Cabrera Island, <i>Middle</i> [3].	39	7	20	2	59	15 —		
Iviza, <i>The Castle</i>	38	53	16	1	28	57 —		
Isle Tagomago	39	0	30	1	40	25 —		

NOTES.

1. **GENERAL NOTE.**—The Charts of the Coasts of Spain and Portugal have heretofore been regulated chiefly by the observations made by *M. Bory*, some of whose results approached very nearly to those which we have given; as of Cape Finisterre, $42^{\circ} 51' 52''$, long. $9^{\circ} 18' 25''$; but others deviate considerably. The longitude of Vigo, given in the Table, appears to be assumed from *M. Bory's* observations of the eclipses of Jupiter's satellites, with the addition of 6 minutes upon re-computation, and a comparison with other observations.

For a more particular detail, see the new Chart of Spain and Portugal, with the harbours, &c., on an enlarged scale, constructed by the Editor, and published by the Proprietor, of this work.

2. **LISBON.**—The longitude of Lisbon had been previously assumed as $9^{\circ} 8' 40''$, being a mean result of observations made by the astronomers *De la Caille*, *Pingré*, and *Messier*, according to a great number of eclipses of the first satellite of Jupiter. The occultation of a star by the moon, Oct. 5, 1753, with a corresponding one at Paris, gave only one minute more.

3. **GIBRALTAR, &c.**—Mr. Chas. Rumker gives the position of Europa Point, Gibraltar, as $36^{\circ} 5' 15''$ N. and $5^{\circ} 20' 15''$ W.: of Alboran Isle, as $35^{\circ} 56'$ N. and $3^{\circ} 3'$ W.: and of Cabrera, as $39^{\circ} 7'$ N. and $2^{\circ} 59' 15''$ W. *Edinburgh Phil. Journal*, Vol. I. p. 322. Don Felipe Bauza, of the Hydrographic establishment at Madrid, gives Tariffa in $36^{\circ} 0'$. This accords with Mr. Rumker; but Captain Livingston made the latitude of Europa Point, by sextant and artificial horizon, in 1820, $36^{\circ} 6' 10''$.

4. **MALAGA.**—The Lighthouse is on the Mole, and exhibits an excellent revolving-light, which may be distinctly seen at the distance of about six leagues. Each face shows seven reflectors. When seen from a distance, it is dark for three-quarters of a minute, and presents a very bright light for 15 seconds, alternately. Thus it seems to revolve every minute; or, at least, brightens and obscures *once* in that time.

5. **PORT MAHON.**—Captain Smyth gives the position of Cape Mola, at Port Mahon, as $39^{\circ} 52' 45''$ and $4^{\circ} 24' 15''$. See his excellent Survey of the Harbour, published by Mr. Laurie.

VARIATIONS OF THE COMPASS.—Captain Smyth found the variation off Portugal, in latitude $38^{\circ} 2'$, long. $14^{\circ} 34'$, to be 23° W. in 1804: and, in 1811, he ascertained it, in different places within the Strait, as follow:

In the Strait, $22^{\circ} 31'$ W.; off Cape de Gatt, $21^{\circ} 40'$; at Alboran, $21^{\circ} 51'$; Cape Palos, $22^{\circ} 0'$; Iviza, $22^{\circ} 2\frac{1}{2}'$; Port Mahon, $21^{\circ} 26'$; Majorca, $21^{\circ} 28'$; Medes, $21^{\circ} 0'$; Cape Sicie, $21^{\circ} 10'$; Calvi, $21^{\circ} 30'$; Caccia Bank, near Sardinia, $21^{\circ} 16'$; Palamos, $21^{\circ} 6\frac{1}{2}'$.

5. COASTS OF AFRICA.

	LATITU. N.			LONGITUDE.			AUTHORITIES.
	°	'	"	°	'	"	
ALGIER, Lighthouse	36	48	36	3	4	40 E.	The observations of Tofino, &c. and those since given in the <i>Connaissance des Temps</i> , to 1825.
Oran, the Castle	35	44	27	0	39	40 W.	
Melilla	35	18	15	2	56	25 —	
Cape Tres Forcas	35	27	55	2	56	25 —	
Ceuta, Mount del Acho	35	54	4	5	16	30 —	
Cape Spartel* [1]	35	48	15	5	54	25 —	{ Latitude, Captain Livingston: Longitude, Tofino, &c.
Rabat (<i>Ent. of the River</i> <i>Bu Regreg</i>) [2]	34	5	0	6	43	0 —	Messrs. Dezoteaux and Borda.
Fas or Fez [3]	34	6	3	4	58	30 —	Don Badia y Leblich, otherwise
MAROCCO, centre	31	37	0	7	35	45 —	called Ali Bey. 1803-4.

COASTS OF AFRICA CONTINUED.

	LATITU. N.			LONG. W.			AUTHORITIES.
	°	'	"	°	'	"	
Cape Cantin	32	35	0	9	4	0	{ Lat. L'Utile, frigate, under M. Cheffant, 1765.
Asfee or Saffi	32	20	0	8	56	0	{ Lat. M. l'Abbe Rochon, &c.
Suerrah or Mogodor Island	31	25	0	9	32	0	{ Lat. L'Utile frigate, above mentioned, 1765.
Cleveland Reef, off Cape Geer	30	45	0	10	23	0	{ Captain Cleveland, 1765.
Cape Geer or Afernie [4] ..	30	38	0	9	52	0	{ Captain le Chev. de Borda, of the Academies Royal of Sciences and of the Marine, 1776.
Entrance of the River Inoon	27	17	0	11	31	0	
Cape Boiador, or Bojador ..	26	12	30	14	27	0	
Cape das Barbas	22	15	30	16	40	0	
Cape Blanco	20	55	30	17	10	0	
Barbary Point, on the N. side of the Bar of Senegal	15	53	0	16	31	30	{ The latitude of Cape Blanco agrees exactly with an observation made by Captain G. Young, in 1771.
Fort St. Louis, in the Senegal	16	3	30	—	—	—	{ M. Adamson, in 1751.
Cape Verde, <i>The Paps</i>	14	43	45	17	30	45	{ Deduced from the operations of Messrs. de Verdun, Borda, and Pingré, 1771.
— The N.W. pitch of } the Cape	14	47	13	17	33	16	{ Requisite Tables, 1802.
Goeree Island [5]	14	40	10	17	25	0	{ M. de Fleurieu, 1769, M. M. de Verdun, Borda, and Pingré.
Cape St. Mary, at the Entrance of the Gambia ..	13	23	0	16	41	0	{ Lat. Captain Henry Billinge: Long. inferred.
North end of the Bissago Shoals	11	40	0	—	—	—	{ Captain S. Gamble, 1789.
Entrance of the Rio Nunez, South Pt. [6]	10	30	0	14	1	0	{ Messrs. James Wesley and Alex. M'Clure.
Ilhas dos Idolhos, or Isles de Los, anchorage of the Eastern I. [7]	9	27	0	13	27	0	{ The latitude by M. Pontezvez Gien; the long. by an English officer, &c.
CAPE SIERRA LEON [8]	8	30	0	13	5	0	{ Captain Sir George Young, Officers of the Argo, Inconstant, &c.
FREE TOWN, Sierra Leon ..	8	29	40	13	0	0	{ Mr. Wm. Woodville.
Cape St. Anne [9]	7	20	0	12	22	0	
North end of the Shoals of St. Anne	8	15	0	13	30	0	{ Observations in the Amelia, Inconstant, &c.
Cape Mount [9]	6	45	10	11	17	30	
Cape Mesurado, or Mon-serrado [10]	6	25	0	10	36	0	{ Ocean, East-India ship, Jan. 1802; Amelia, frigate, 1812.
Grand Sestros, or Sesters ..	4	40	0	8	4	0	{ Royal Charlotte, East-India ship, Inconstant, frigate, &c.
Cape Palmas [11]	4	30	0	7	41	0	{ Sir G. Young, Requisite Tables, Royal Charlotte, E.I.M. 1793, and Inconstant, frigate, 1816, 1817, all agreeing.
St. Andrew's Bay	5	0	0	6	3	0	{ Sir G. Young, Messrs. Norris, De Mayne, and Finlaison.
Lahou, the Town	5	13	30	4	47	0	{ Lat. mean between Sir G. Young and Mr. De Mayne: Long. inferred from St. Andrew's Bay.
Cape Apollonia [12]	4	59	12	3	0	0	{ Lat. Requisite Tables, &c. Long. mean between the same and the observations of Mr. De Mayne.
Fort Apollonia	5	0	15	2	54	26	

COASTS OF AFRICA CONTINUED.

	LATITUDE.			LONGITUDE.			AUTHORITIES.
	°	'	"	°	'	"	
Cape Three Points, Western Pt.	4	43	0 N.	2	39	0 W.	Mr. Ant. De Mayne, H.M. Ship <i>Amelia</i> , 1812.
St. George del Mina, or Elmina	5	1	0 —	1	45	0 W.	Lat. Mr. De Mayne: Mr. Crear, in the <i>Inconstant</i> , made the latitude $5^{\circ} 0'$; the Requisite Tables, $5^{\circ} 1' 38''$.
Cape Coast Castle Road [13]	5	3	30 —	1	38	0 W.	Lat. <i>Amelia</i> and <i>Inconstant</i> , differing only one minute. For the longitude, see Note 13.
Annamaboe	5	8	30 —	1	26	0 W.	Lat. Mr. De Mayne's Chart, &c.: Long. inferred from Cape Coast Castle.
Cormantine	5	10	0 —	1	20	0 W.	Lat. Req. Tables: Long. inferred from Cape Coast Castle.
Accra [14]	5	27	30 —	0	10	0 W.	Lat. mean between the <i>Amelia</i> and <i>Inconstant</i> : but both make the longitude more to the East.
Cape of St. Paul	5	44	0 —	0	54	0 E.	The mean of several observations.
Quitta	5	55	0 —	1	2	30 —	
Little Popoe	6	11	52 —	1	34	0 —	Lat. mean between the <i>Amelia</i> and <i>Inconstant</i> : Longitude inferred.
Whydah, factory	6	17	0 —	2	7	0 —	Lat. Mr. De Mayne: Long. <i>Inconstant</i> , Sir James Yeo, 1817, &c.
Porto-nova	6	17	30 —	2	38	0 —	Lat. Mr. De Mayne: Longitude, <i>Inconstant</i> , (lunars), &c.
Lagos River [15]	6	22	30 —	3	27	0 —	Lat. Mr. De Mayne: Longitude inferred.
Entr. of River Benin	5	40	0 —	5	2	0 —	Lat. Capt. Archibald Dalziel, 1785: Long. inferred.
Cape or Point Formosa	4	20	30 —	5	30	0 —	The mean of several discordant observations. Mr. De Mayne gives the lat. of the River as $5^{\circ} 8'$, and the long. of the Cape $6^{\circ} 0'$.
Ramos River	5	6	0 —	5	20	0 —	
Fernando Po, N.W. Bay [16]	3	28	0 —	8	2	0 —	Lat. Conn. des Tems: Longitude inferred.
Prince's Island, Fort of S. Antonio, on the E. side [17]	1	27	0 —	7	26	0 —	<i>Inconstant</i> Sir Jas. Yeo, 1816, confirming a previous statement.
St. Thomas's, Man of War Bay [18]	9	27	0 N.	6	48	0 —	Lat. mean of several accordant observations. Long. mean and Conn. des Tems.
Anno Bona, or Anno Bon, Road [19]	1	25	0 S.	5	45	0 —	Don Jos. Varela, 1779; Queen, E.I.S., 1796, &c. confirmed by Capt. A. Bristow and other commanders.
Bimbia	3	52	0 N.	8	54	0 —	Inferred, by a Manuscript Chart.
Cape St. John [15]	1	15	0 —	8	49	0 —	Latitude, <i>Inconstant</i> , &c.
Cape Clara	0	27	0 —	8	54	0 —	Long. inferred, as shewn in Note 8.
Cape Lopez [15]	0	58	53 S.	8	58	0 —	Lat. Mr. De Mayne. Long. inferred as above.

NOTES.

1. **CAPE SPARTEL.**—In the *Connaissance des Temps*, this Cape is now stated to be in latitude $35^{\circ}48'40''$, and longitude $5^{\circ}53'25''$. In the *Requisite Tables* it is stated to be in latitude $35^{\circ}46'0''$, longitude $5^{\circ}57'12''$. The remarks of the late Mr. William Chapman, master of H.M.S. the *Illustrious*, appear to confirm the longitude of Tofino, with whom he differs only 40 seconds in latitude, which he represents as so much more to the southward. The observations of Captain Smyth give the latitude $35^{\circ}47'15''$, and the longitude $5^{\circ}55'45''$, by chronometer and lunars. Those of Captain Livingston, in 1818, confirm the latitude as in the Table.

Captain Livingston has informed us, that "There is a range of well-defined basaltic columns, appearing like a coronet, around the west side of Cape Spartel, and about one-third of the whole height from the summit. Though not to be compared with those of the Giant's Causey, Ireland; or Staffa, in the Hebrides, I think them the next finest I have seen."

2. **RABAT.**—The longitude was calculated by M. Mechain, from the eclipse of the sun in June, 1778, observed by M. Dezoteaux. The latitude was observed by Messrs. Borda, Verdun, and Pingré, whose voyage will be noticed hereafter.

3. **FAS and MAROCCO.**—The scientific traveller, to whom we owe the positions of these cities, states that his calculations were founded on numerous observations, made with most excellent instruments. The foggy atmosphere, he adds, often interrupted his labours, but he is satisfied with the correctness of the result. The observations were made near the centre of the respective places. (*Travels of Ali Bey*, London, 1816.)

4. **CAPE GEER to the SENEGAL.**—M. le Chevalier John Chas. de Borda was charged, in 1776, by Louis XVI., with a commission to the Canary Islands and the Coast of Africa, for the express purpose of making observations, and determining the chief points of the Canary Islands, &c. He was furnished with time-keepers, by which he ascertained the positions, as they now appear, and which have been introduced in different Charts and Tables. On this expedition, M. de Borda, in the ship *La Boussole*, was accompanied by the *Espeigle*, M. le Chastenet Puysegur, who afterwards composed the Pilot for St. Domingo; also by Captain Don Josef Varela, and another intelligent officer of the Spanish marine; all of whom assisted in the operations: so that, it is to be presumed, they may be confidently relied on.

5. **GOEREE.**—The position of Goeree has been confirmed by observations made in the *Argo* frigate, Captain Hallowell, 1802, which gave the latitude $14^{\circ}39'$, and longitude, by time-keeper, $17^{\circ}24'58''$. The variation, at the same time, was $14^{\circ}4'W$.

6. **RIO NUNEZ.**—Bencer Point, the south point of the Rio Nunez, has been laid down in former charts in $10^{\circ}14'N$. But, according to observations taken by Mr. James Wesley, commander of the James schooner, some years since, it lies in $10^{\circ}30'$. The observations of Mr. Pine, another merchant-commander, made it at the same time $10^{\circ}28'$. Captain Wesley was there several times, and always made it as above.

The ship *Horizon* was at anchor off this place in Feb. 1805, when her latitude was found by Mr. A. McClure to be $10^{\circ}23'$, and the longitude, by lunars, $14^{\circ}1'$. Bencer Point then bore N.E. $\frac{1}{2}$ E. (true) 7 or 8 miles distant, and Cape Verga S.E. by E. This furnishes a confirmation of Captain Wesley's observations.

The error may probably have originated from M. D'Anville's Chart of the Coast between Cape Blanco and Cape Verga; in which the south point of the River Nunez is placed in $9^{\circ}35'$ instead of $10^{\circ}30'$, or about 55 minutes south from the latitude in which it ought to appear.

From the Rio Nunez, to the southward and eastward, there is yet some uncertainty, in several instances, as to the longitudes of places. This uncertainty has remained, not so much from the absolute want of observations, as from discordancy in the results of numerous observations which have been made. In the former editions of this work we exhibited all that could be collected on the subject, and we have since received a series of observations on the coast and islands, made by the officers of the *Amelia* frigate, under

under the Hon. F. P. Irby, Mr. De Mayne, master, in 1812; another series by those of the *Inconstant* frigate, Captain Sir Jas. Yeo, Mr. Crear, master, in 1816 and 1817; another by those of the *Tartar*, Comm. Sir Geo. Collier, Mr. Finlaison, master, in 1821; some others were made in the voyage of the Congo sloop, Captain Tuckey, Mr. Fitzmaurice, master, in 1816. All these have been carefully compared with each other, with the charts constructed from them, and with former observations, charts, and bearings. The results are shown hereafter.

7. **ILHAS DOS IDOLHOS, or IS. DE LOSS.**—The Requisite Tables state the latitude as in the Table above, and the longitude $13^{\circ} 32' 30''$. Mr. Wm. Woodville states the longitude, from lunars, at $13^{\circ} 16'$. The position given in the *Connaissance des Temps* (1825) is $9^{\circ} 27' N.$ and $13^{\circ} 20' W.$ That of the Admiralty Chart is $9^{\circ} 29' N.$ and $13^{\circ} 39' W.$ The difference of longitude between these isles and Cape Sierra Leon is about 22 minutes: hence we infer that they cannot lie farther out than $13^{\circ} 27' W.$

8. **SIERRA LEON, and COAST OF GUINEA.**—The observations, which have been hitherto made for determining the situations of the points of the Coast of Guinea, &c., have, as yet, left the matter very imperfect; and, although we have paid the utmost attention in the comparison of different results, charts, and descriptions, as shown in the Table and subsequent Notes, we are by no means satisfied with the conclusions as to many points eastward of Cape Palmas and St. Andrew's Bay. Indeed, all that has yet been done by the king's officers, and others, prove only the necessity of a new series, in order to establish so much as may be correct, and to reform so much as may not be so. For instance, Cape Three Points is represented in the Admiralty chart as in $2^{\circ} 6' W.$: Captain Horsburgh gives it in $2^{\circ} 41'$: we have it in $2^{\circ} 39'$. Cape Coast, in the Admiralty chart, appears in $1^{\circ} 3' W.$: we have it in $1^{\circ} 38'$. Whydah is placed in the Admiralty chart in $2^{\circ} 35' E.$: we have it in $2^{\circ} 7'$: the *Inconstant* frigate, in 1817, made it only $2^{\circ} 5'$. The Admiralty chart gives Porto Nova in $3^{\circ} 8'$: the *Inconstant's* lunars gave it $2^{\circ} 40'$. Cape Formosa is placed in the Admiralty chart in $6^{\circ} 0' E.$: Captain Horsburgh gives it in $5^{\circ} 5'$ only: we have assumed $5^{\circ} 30'$.—But, with regard to St. Thomas's and Anno Bon, our doubts have ceased.

Cape Sierra Leon, the promontory on the south side of the entrance of the river, is called by the French *Cape Ledo*, or *Tagrin*. According to the observations of Sir George Young, this cape lies in latitude $8^{\circ} 30'$, longitude $12^{\circ} 33' 47''$; but the officers of H.M.S. the *Argo*, 1802, place it in $8^{\circ} 29'$, long. $13^{\circ} 12'$. The Requisite Tables, in $8^{\circ} 29' 30''$, and long. $13^{\circ} 9' 17''$. The French Tables, lat. $8^{\circ} 33'$, long. $12^{\circ} 54'$. The *Inconstant*, in 1816, made the longitude in the harbour, $13^{\circ} 5'$; in 1817, $13^{\circ} 12'$: the *Amelia*, in 1812, $13^{\circ} 17\frac{1}{2}'$. Upon the whole, on comparing charts, &c., we conclude the longitude to be as given in the Table, or a little more to the west.

As the entrance of the river is not more than seven miles broad, we presume that the little isle, called Leopard's Isle, lying on the north side, must be in $8^{\circ} 37' N.$, and not $8^{\circ} 40' 10''$, as stated in the Requisite Tables. The latitude of *Freetown* is likewise stated, in the same work, to be rather to the northward, instead of to the southward, of the Cape.

9. **CAPE ST. ANNE to CAPE MESURADO.**—Cape St. Anne is stated in the Requisite Tables to be in latitude $7^{\circ} 7' 30''$, longitude $12^{\circ} 22'$. The longitude appears to be correct, or very near the truth, but the latitude otherwise. The Admiralty chart, by Mr. De Mayne, places the cape as high as $7^{\circ} 26'$. It may be presumed, therefore, that the latitude has been misprinted, and the charts have, in consequence, suffered by the error. In the same table, Cape Mount is stated as in latitude $6^{\circ} 46'$, longitude $10^{\circ} 40'$; but both of these have been rejected as erroneous.

The observations of the *Amelia*, frigate, 1812, placed Cape Mount in $6^{\circ} 43\frac{1}{2}' N.$ and $11^{\circ} 15' W.$; those of the *Inconstant*, in 1816, in $6^{\circ} 46' N.$ and $11^{\circ} 20' W.$

10. **OF CAPE MESURADO** the position was observed, by the officers of the Ocean, E.I.S., in Jan. 1802. On the 20th of that month the land was seen, with Cape Mesurado distant about 9 leagues, no ground with a line of 120 fathoms. The latitude then observed was $6^{\circ} 7' N.$; longitude, per chronometer, $11^{\circ} 0' W.$, by lunar observation, $10^{\circ} 50'$, whence the situation of the cape was deduced at about $6^{\circ} 27' N.$, longitude $10^{\circ} 35' W.$ On the next day, the mean result of observations, lunar and chronometric, gave $10^{\circ} 36'$ for that of the cape.

11. **CAPE PALMAS.**—Viscount Valentia has remarked that this cape lies in eight degrees West: we know not his reasons for stating it to be so, and presume that he is incorrect. The Admiralty Chart represents Cape Palmas in $4^{\circ} 23' N.$ and $7^{\circ} 40'$; but *all the rest agree* in the position given in the Table; and this headland may, therefore, be considered as finally determined.

12. **CAPE APOLLONIA, &c.**—The last edition of the Requisite Tables, 1802, gives the positions of the Cape and Fort of Apollonia, Capé Three Points, St. George del Mina, Annamaboe, and Fort Cormantine, as they were formerly represented in other works; but it now appears that all the longitudes of these places were given too much to the west; Cape Apollonia at least ten minutes; Cape Three Points, four and a half minutes; Mina, fifteen minutes; Annamaboe and Cormantine, thirteen minutes. The Admiralty surveyors seem, on the contrary, to have the longitudes of many points too far to the east. Mr. De Mayne's longitude of Cape Apollonia is less than $2^{\circ} 50' W.$; but we presume, from comparison, that his Cape Three Points is near the truth, and have adopted it.

13. **CAPE COAST CASTLE.**—The longitude of Cape Coast Castle has, heretofore, been variously exhibited. Mr. De Mayne has represented it in $1^{\circ} 10' W.$; the *Amelia*, in $1^{\circ} 6'$. Hence we formerly gave it in $1^{\circ} 10'$. But the government commissioners, Messrs. Ludlam and Dawes, in 1810, placed it in forty-one minutes more to the West; that is, in $1^{\circ} 51'$. This is, doubtless, too far to the West; but the observations made by Mr. Bowdich, on the Mission to Ashantee, in 1817, have inclined us to believe that the error is not so great as had previously been supposed: for Mr. Bowdich gives the longitude of Payntree's room as $1^{\circ} 47' W.$, and of Dompasie (by an eclipse of Jupiter's first satellite) as $2^{\circ} 6'$. Our correction has been effected simply by a proportional scale applied to the particular chart, and the longitude is thus assumed as $1^{\circ} 38' W.$ The true longitude is probably a few minutes more to the eastward.

14. **ACCRA.**—The government commissioners, Messrs. Ludlam and Dawes, in 1810, made the longitude precisely the same as we had deduced it, $0^{\circ} 10' W.$ But this is not to be considered as conclusive; although the coincidence may be assumed as corroborative.

15. **CAPE COAST CASTLE to ST. THOMAS'S, CAPE LOPEZ, and BENGUELA.**—Although the Port of Benguela lies in the parallel of $12^{\circ} 29'$ South, and, therefore, far distant, it is necessary here to take a general view of the authorities on which depends the delineation of the coast to that place.

From the longitude of Cape Coast Castle, we gain, by inference, the longitudes of Annamaboe and other places to the eastward, having no other longitude, which can be considered as really determined until we arrive at Prince's Island, St. Thomas's, Anno Bona, and Benguela. The latter is, therefore, a most important one, because it tends to rectify all the intermediate coast.

Captain Peter Heywood, in H.M. ship *Nereus*, visited Benguela on the 29th of Jan., 1811, when the flagstaff, by chronometers, from St. Helena, appeared to be in longitude $13^{\circ} 26' 30''$; lunar observations gave $13^{\circ} 35'$; but the subsequent return to St. Helena gave $13^{\circ} 28' 45''$, the longitude which we have assumed. The surprising degree of accuracy which we have generally found in Captain Heywood's very numerous observations, as well as the particular circumstances of this route, incline us to give his result with a confidence which we should not readily concede to an ordinary, or less experienced, observer.

Mr. De Mayne, in his survey of Benguela Bay, in 1812, gave the latitude as $12^{\circ} 33\frac{1}{2}'$, and the longitude as $13^{\circ} 55'$.

CAPE PADRON, in latitude $6^{\circ} 12' S.$, was formerly laid down in longitude $12^{\circ} 25'$, being the mean result of ten sets of lunar distances, taken by Captain J. A. Wood, in H.M. ship *Garland*, 1798. We have placed it only four minutes more to the east; but the *Amelia*'s observations, by chronometer, fifteen days from St. Helena, made it $12^{\circ} 33'$; and the officers on the expedition to the Congo, in 1816, made it $12^{\circ} 40'$. The last is totally rejected, and we fear that none of the longitudes given in Captain Tuckey's Narrative are entitled to farther notice.

THE MAIN LAND OF AFRICA, in latitude $1^{\circ} 37' S.$, was observed in the Lord Eldon, East-Indiaman, 1802; when lunar observations, with the mean of three chronometers, gave the longitude as $9^{\circ} 8' E.$ But the Georgiana, by lunars, 4th October, 1798, in latitude $1^{\circ} 9' S.$, made the longitude of that part of the coast $9^{\circ} 16'.$; and hence we may conclude, that the landfall of the Lord Eldon should be rather more to the eastward. Thus we advance towards the longitude of Cape Lopez, which has not been definitively ascertained. Mr. De Mayne has, indeed, given the latter as $9^{\circ} 17' 30''.$; but this, we presume, is too far to the east by about nineteen minutes. Captain Horsburgh, from former observations, gives it in only $8^{\circ} 40' E.$

BIMBIA is given from a manuscript draft of the Gulf of Biafra, in the possession of Mr. Laurie, and which, as well as other charts, exhibits it only five minutes to the west of the meridian of Cape Lopez.

CAPE ST. JOHN was given from observations made in the Inconstant, 1816, as in $1^{\circ} 15' N.$ and $9^{\circ} 15' E.$ CAPE CLARA, on the north side of the River Gaboon, from the same, as in $0^{\circ} 24' N.$ and $9^{\circ} 15' E.$ The first, as shown in the table, from reasons already explained, we reduce to $8^{\circ} 49' E.$, and the latter to $8^{\circ} 54' E.$

Mr. Bowdich says, that the entrance of the River Gaboon is placed by some in $30' N.$ and $8^{\circ} 42' E.$, by others on the equator, and in $9^{\circ} 23'.$ He adds, the former longitude is the more correct, judging from three *reckonings* of the vessel in which he visited it; but he had not the requisites for an observation. The former latitude is, he says, the correct one of Cape Clara.

16. FERNANDO Po is stated, both by the *Connaissance des Temps*, and *Requisite Tables*, as in $3^{\circ} 28' N.$ and $8^{\circ} 40' E.$ by chronometer. The same observation, it may be presumed, has served for both. Our documents place the N.W. bay about 74 minutes east of Man of War Bay; and, as the latter best agrees with the corrected coast to the northward, we have adopted it.

17. PRINCE'S ISLAND.—The position of the port of this island is given, in the *Requisite Tables* and *Connaissance des Temps*, as $1^{\circ} 37' N.$ and $7^{\circ} 40' E.$ But the difference of longitude, according to better documents, prove this to be incorrect. The Glatton, in 1799, made this island, by estimation, more to the west than we have given it; but, as it lies to the eastward of a right line drawn from the western extremities of St. Thomas and Fernando Po, this cannot be taken into account. The Inconstant, Sir James Yeo, in 1816, made the S.E. Bay as stated in the Table, and this, so far as we can judge from other observations, appears to be correct.

18. ISLAND OF ST. THOMAS.—The anchorages of St. Thomas are on the eastern and northern sides of the island. Between them is the islet Cabrita, off the N.E. coast. The northern one, which has the greatest depth of water, is called Man of War Bay; and the southern, St. Anna de Chaves Bay. The latter is stated, in the *Connaissance des Temps*, to be in longitude $6^{\circ} 48'.$; and in the *Requisite Tables*, in $6^{\circ} 42' 30''.$; the Inconstant, 1816, made the longitude of Man of War Bay $6^{\circ} 42'.$; and, in 1817, $6^{\circ} 46'.$ The Amelia, in 1812, made it $7^{\circ} 4'.$ But, upon the whole, we conclude that $6^{\circ} 48'.$ is correct. Captain Horsburgh gives the north end as in only $6^{\circ} 37' E.$

19. ANNO BONA, or ANNO BON.—We have repeated the position as in our former editions, from the assurance of several commanders that it is correct. Captain Varela concluded the longitude of the roadstead on the eastern side of the island to be $5^{\circ} 45' E.$ and the Queen's chronometer indicated the western side to be in $5^{\circ} 32'.$ The Inconstant, in 1817, made the N.E. point of the island $1^{\circ} 25' S.$ and $5^{\circ} 42' E.$

- VARIATIONS OF THE COMPASS.—At Centa, in 1811, the variation was $22\frac{1}{2}^{\circ} W.$: at Cape Spartel $22^{\circ}.$ Between Cape Spartel and Saffi Bay it is, at present, from 22° to $21^{\circ} W.$: At Morocco, in 1804, it was found to be $20^{\circ} 38' 40'' W.$: Between Saffi Bay and the Canary Islands it is 20° : near Cape Blanco 19° ; decreasing to Cape Verde and Cape Roxo to $14^{\circ}.$ From this part to the eastward it again increases; and we find it, near Cape Sierra Leon (1819) 16° : at Cape Mesurado 17° : at Cape Three Points 20° : at Cape Formosa 22° : at St. Thomas's, Prince's, and Anno Bon, Islands, 22° to $23^{\circ}.$

6. THE AZORES OR WESTERN ISLANDS.

(Originally ILHAS DOS AÇORES, or ISLES OF HAWKS.)

	LAT. N.			LONG. W.			AUTHORITIES.
	°	'	"	°	'	"	
FORMIGAS OR ANTS, Middle of the greatest.....	37	16	50	24	54	18	Mons. C. P. Claret Fleurieu, 1769; and Don Vincente Tofino, 1788.
SANTA MARIA, OR ST. MARY, Pt. do Castello, or S.E. Point	36	56	47	25	6	0	
Town of St. Mary.....	36	58	0	25	12	33	
Pt. de Maldemarenda, or S.W. Point [1].....	36	57	31	25	14	18	
SAN MIGUEL, OR ST. MICHAEL'S, Ferreria, or West Point..	37	54	15	25	55	30	
City of Ponta Delgada...	37	45	10	25	41	30	REMARKS. The longitude of St. Michael's is given from Tofino's separate result, which is more easterly than that of Fleurieu. A late Chart of St. Michael's, published by the British consul, Mr. W. H. Read, exhibits the city in 25° 36' W. only, and our friend Captain Livingston, from four sets of lunar distances, taken on board the ship Asia, 4th and 5th October, 1818, made it 25° 35' 40" W. It may, therefore, be a little to the eastward of the position given in the Table.
Pt. de la Marquesa, or East Point [2].....	37	48	10	25	10	20	
TERCEIRA, Mt. de Brasil, near Angra, [3].....	38	38	33	27	12	48	
ST. GEORGE, Pta. del Topo, or S.E. Point [4].....	38	29	22	27	50	42	
GRACIOSA, Pta. del Carapacho, or S.E. Point.....	39	0	0	27	58	0	
PICO, The Summit of the Peak.	38	26	15	28	28	13	
FAYAL—The S.E. Point, or Morro de N.S. de la Guia [3]	38	30	12	28	41	52	
FLORES—The North Point, or Ponta del Gada [5].....	39	33	29	31	8	30	
CORVO—The Southern Point, or Pta. del Pesqueiro-alto...	39	41	13	31	3	0	

NOTES.

1. AZORES.—The voyage of M. Flurieu, in the Isis frigate, made in 1768-9, and published in 1773, has furnished several observations of the points of the Azores, as shown by the marine-clocks of M. Ferdinand Berthoud, and verified, in great measure, by more numerous observations of Don Vincente Tofino, made in 1788. The difference in the results of these two observers is, generally, inconsiderable; so small, indeed, that it may rather be considered as an agreement.

M. Fleurieu ascertained the position of the Mount of Brasil, near Angra, in Terceira, to be 38° 38' 37" N. and 27° 12' 42" W. Tofino's result was 38° 38' 10", and 27° 12' 55", a remarkable coincidence, considering the distance of time at which the observations were made. The longitude of this spot was, therefore, assumed by the Spanish commander, as the meridian referred to from the points subsequently determined.

We know not upon what authority the *Connaissance des Temps*, some time ago, placed the S.E. point of St. Mary in 25° 18' 45" W. But the town of St. Mary, as given in the *Requisite Tables*, 36° 56' 40" and 25° 9' 10" is M. Fleurieu's separate result, in 1769.

2. ST. MICHAEL'S.—The *Connaissance des Temps* has lately altered its longitude of the Eastern point of St. Michael's from 25° 22' 22" to 25° 13' 30". Were this the longitude of the East point, that of Ponta Delgada would be about 25° 44' 40".

3. TERCEIRA AND FAYAL.—The French Table lately gave the Mount of Brasil, in Terceira, in 27° 23' 40" W., and the S.E. point of Fayal in 28° 52' 48". The first has been relinquished, and the second altered to 28° 42' 3". The town of Fayal, according to obser-

observations made by Mr. W. Wales, in Captain Cook's second voyage, is $38^{\circ} 32' 20''$ N. and $28^{\circ} 41' 5''$ W.; the Requisite Tables give the town in this position, which tends to confirm the position shown in the Table.

4. The position of St. GEORGE, as given in the Requisite Tables, is erroneous. It states that island to be in $38^{\circ} 53' 30''$ N. and $28^{\circ} 10'$ W. The north point does not appear to be higher than $38^{\circ} 45'$.

5. FLORES and CORVO.—The longitude of these islands is given according to the results of Tofino only; having inferred, on comparison, that they are the most exact. Vide the Chart of the Azores, Canary Islands, and opposite coasts, with the harbours, &c., constructed by the editor, and published by the proprietor, of this work. The late Sir Home Popham, from several observations, lunar and chronometric, inferred the longitude of the North point of Flores as $31^{\circ} 11'$, or $2^{\circ} 30'$ more to the westward than the position assigned by Tofino.

VARIATION OF THE COMPASS.—At St. Michael's, in 1806, the variation appeared to be 23° W. At Flores, $18\frac{1}{2}^{\circ}$ W. Mr. Read states that, not long since, the variation at St. Michael's appeared to have increased to $2\frac{1}{2}$ points, but that it has lately decreased. Captain Livingston, by mean of many observations, found it about 25° W. in 1818. This gentleman properly observes, that these differences may be ascribed to the volcanic commotions and ferruginous nature of the country. See Note on the variation at Tenerife, hereafter.

7. THE MADEIRA AND CANARY ISLANDS.

	LAT. N.			LONG. W.			AUTHORITIES.
	°	'	"	°	'	"	
MADEIRA.							
Town of Funchal [1].....	32	38	0	16	54	26	Capt Matt. Flinders, H. M. S. Investigator, 1801; General Sir Thos. Brisbane, 1821.
Punta del Pargo, the West Pt.	32	49	0	17	22	0	
Pta. de S. Lorenzo, the E. Pt.	32	43	20	16	39	0	Deduced from Funchal.
PORTO SANTO. The village on the South side [2]	33	3	0	16	17	30	
THE SALVAGES.							
Middle of the Great Salvage [3]	30	8	30	15	55	0	The observations, by chronometers, &c. of M. le Chev. de Borda, under the order of the French Government, in 1776. See Note 4, on the Coast of Africa, page 16.
LANZAROTA, or LANCEROTE.							
Alleganza, I. off the North End	29	25	30	13	31	0	
Port de Naos	28	58	30	13	33	0	But the general mean of the longitude of the Mole of Santa Cruz, from the observations of Captains Perouse, Bligh, Vancouver, and Krusenstern, of M. Quenot, and the Baron Alexander de Humboldt, is $16^{\circ} 15' 18''$. The latter, by a Berthoud's chronometer, made it $16^{\circ} 13' 10''$, in 1799.
FORTAVENTURA.							
I. of Lobos, off the N.E. Pt. ...	28	45	0	13	49	0	
Pt. Handia, the S.W. Pt.	28	4	0	14	31	30	CANARIA, or GRAND CANARY.
THE ISLETA, or N.E. Pt.	28	13	0	15	25	0	
Pt. Arguinequi, the South Pt.	27	45	0	15	38	30	
Pt. Aldea, the West Pt.	28	1	20	15	51	0	TENERIFE, or TENERIFFE.
Mole of Santa Cruz [4]	28	28	30	16	16	0	
Le Pic, or the Peak	28	17	0	16	40	0	
L'Orotava (N.W. side)	28	25	0	16	35	0	GOMERA.
The Port	28	5	40	17	8	0	
PALMA.							
Sta. Cruz, on the E. side [5]	28	43	0	17	46	0	FERRO.
Tasacorta, on the W. side ...	28	38	0	17	58	0	
Town of Valverde [6]	27	47	20	17	57	0	La Dabessa, or Western Point
La Dabessa, or Western Point	27	44	0	18	10	0	

NOTES.

1. FUNCHAL.—The latitude of Funchal is well ascertained. The longitude was estimated by M. Bory, in 1772, at $16^{\circ} 56'$, as it now stands in the French Tables. Capt. Horsburgh, in his first edition, states that he found it, by good chronometers, $17^{\circ} 6'$; and Mr. Wales's observations, by time-keeper, in 1772, gave $17^{\circ} 6' 22''$. By an eclipse of the sun and eclipses of Jupiter's satellites, in 1788, noticed on Mr. Johnston's Survey of Madeira, it appeared to be $17^{\circ} 5' W$.

Harrison's time-keeper, in 1763, gave $17^{\circ} 10' W$.; and Arnold's, on board the Grenville, 1775, only $16^{\circ} 46'$. The mean, by several chronometers of Capt. Charles M'Intosh, in 1809, gave $16^{\circ} 50'$; and those of Capt. P. Heywood, R.N., 1810, gave $16^{\circ} 51'$.

These differences were, at length, decided by our late respected countryman Captain Flinders; from whose observations, in H.M.S. ship Investigator, 1801, the latitude of the Road appeared to be $32^{\circ} 37' 44''$, and the greatest longitude, by any of six time-keepers, $16^{\circ} 54' 26''$. "This was given by Earnshaw's watch, No. 465, which had kept an uniform rate during fifteen months previously to its being brought on board. We made use of this watch to reduce some lunar observations taken a few days before arriving at, and others after sailing from, the place of anchorage; and the result was as follows:—

"Ten sets of distances, east and west of the moon, taken by Mr. Crosley, in Funchal Bay, and afterwards, with a Troughton's sextant, $16^{\circ} 59' 21''$.

"Eight sets, east and west, taken by me with a Troughton's circle and two sextants, before and afterwards, $16^{\circ} 51' 28''$."

Hence, west longitude of Funchal, by lunar observations—*Mean* $16^{\circ} 55' 24''$. The *Variation*, in 1811, was $21^{\circ} W$.

Since the above was written, we have been informed by Mr. William Smith, Master of H.M.S. Ganymede, that, by observations taken 9th August, 1818, Funchal Road appeared to be in $32^{\circ} 37' 33'' N$. Longitude, by chronometer, $16^{\circ} 55' 30''$; by lunars, $16^{\circ} 57' 15''$. Mr. J. Town, Master of the Salisbury, in Feb. 1816, made the longitude, by chronometer, $16^{\circ} 55' 42''$.

His Excellency Sir Thomas Brisbane, on his voyage to New South Wales, (1822,) obtained his time at the house of Mr. J. W. Gordon, at Funchal, by four excellent chronometers, from which the mean longitude was concluded as $16^{\circ} 54' 36''$. At the same time the latitude of the tower, on Mr. Gordon's house, was found to be $32^{\circ} 38' 19''.7$, and that of the Loo Rock $32^{\circ} 37' 53''.8$. The longitude given by Sir Thomas Brisbane, seems to have been confirmed by the Admiralty chronometers, under the care of Dr. Tiarks, in 1823, which gave for the longitude of the British Consul's garden $16^{\circ} 54' 45''$. (In time, 1*h.* 7*m.* 39*s.*)

DESERTAS.—Captain Flinders found the southern end of the Bujio to be in latitude $32^{\circ} 24' 20''$, which differs less than a mile from its position as given on the charts; and he discovered a small ledge of rocks projecting from under the cliffs at the S.W. part of this island.

2. PORTO SANTO.—A plan of this island, from a Survey by Lieut.-Colonel Roberts and Captain Thomas Wolley, of H.M. ship Arethusa, 1802, states, in general terms, the latitude of the town to be $33^{\circ} 2'$, and its longitude $16^{\circ} 35'$, which is only 20 minutes East of the meridian of Funchal. But, upon a comparison of this statement with the different tables and charts, we are apprehensive that the difference should be at least 37 minutes, and have so assumed it in the Table. See the Chart of the Azores and Canary Islands, before mentioned. The Req. Tab. and Conn. des Tems, give the latitude of the middle of the isle $33^{\circ} 5'$, and the longitude $16^{\circ} 14' 51''$, and $16^{\circ} 17' 30''$. The latter appears to be correct.

3. THE SALVAGES.—The longitude of the Great Salvage, as lately furnished by Five British East-India Journals, differs from $15^{\circ} 34'$ to $16^{\circ} 1'$. The mean result of these is $15^{\circ} 48' W$. Yet we have not deemed this evidence sufficient to cause a deviation from the position assigned by M. de Borda.

M. la Perouse has observed, "We were employed on the 18th of August, 1785, in taking observations off the Salvage, and I think its longitude may be fixed in $18^{\circ} 13'$, $15^{\circ} 53'$ from Greenwich,) and its latitude $30^{\circ} 8' 15''$."

Lieut. Wm. Mudge, R.N., who, with Lieut. Vidal, surveyed the Great Salvage in 1820, places its south side in $30^{\circ} 7' 39''$ N. and $15^{\circ} 56' 18''$ W.; and he says of it, "This island is obviously of volcanic origin, and consists principally of a dark-coloured black rock, the detached parts of which, as well as the whole, exhibit strong marks of fixed magnetic polarity. Even the dust of the roads, and of the floors of the cottages, has the same character as the rock itself, and may be gathered up, like steel filings, by means of a bar magnet."

"The compass was singularly deranged at the three stations taken on the survey, and the extreme difference in its variations amounted to about seventy-two degrees, at a less distance than one mile. At the first station, one morning, Mr. Durnford, one of the party, laid down his watch, and on returning to the same place again it was found that the watch had gained two hours in the interval, an acceleration due to the magnetic action of the rock upon the balance."

4. TENERIFE.—The position of Sta. Cruz, given in the Table, has been sufficiently confirmed. M. la Perouse says, "Several observations were made at Santa Cruz, in Tenerife, which we think may be fixed at $18^{\circ} 36' 30''$ ($16^{\circ} 16' 30''$ from Greenwich,) and $28^{\circ} 27' 30''$ N. But the situation of the Peak, as given in the Requisite Tables, is $5' 33''$ more westerly than that given by M. de Borda. Mr. Dalrymple's observations, by chronometer, 1775, gave it 12 minutes more to the eastward."

5. PALMA.—The observations of Captain L. Wilson, by chronometer, place the north point of Palma between 6 and 7 minutes to the East, and the south point 3 minutes to the West, of M. de Borda's positions. This is a farther confirmation of the accuracy of that excellent observer. On the 21st of February, 1818, Captain J. W. Monteath made the longitude of the Point of Santa Cruz, on this island, by chronometer, to be $17^{\circ} 45' 30''$ W., and the latitude of Point Turco, on the North side, $28^{\circ} 51' 30''$ N., and longitude $17^{\circ} 48' 30''$ W.

6. FERRO.—It is, however, suspected that the Isle of Ferro is placed a few minutes too far to the West; and, probably, if we assign to the middle of it the meridian of $18^{\circ} 0'$, we shall be nearer to the truth. This meridian (the *first meridian* of the antients) has heretofore been assumed, by different geographers, as $17^{\circ} 40'$ and $17^{\circ} 45'$ W.

VARIATIONS OF THE COMPASS.—Between Porto Santo and Madeira, the mean Variation is about 20 degrees. In the Road of Santa Cruz, Tenerife, it is rather less, if we may conclude that it has been correctly ascertained: but M. de Humboldt has noticed that the variation differs several degrees, according to the place where the observation is made, at the Mole, or at several points to the north, along the shore: and, he adds, we must not be surprised at these deviations in a place surrounded by volcanic rocks. "I remarked with Mr. Gay Lussac, that, on the declivity of Vesuvius, and in the inside of its crater, the intensity of the magnetic forces is modified by the proximity of the lavas.—*Personal Narr.* Vol. I. 117."

According to Mr. Finlaison's observations, made in the Tartar, in 1819, the variation in the Road to Funchal was only $19^{\circ} 20'$ W. and in that of Santa Cruz, Tenerife, he found it $17^{\circ} 20'$ only.

8. THE CAPE VERDE ISLANDS.

	LAT. N.			LONG. W.			AUTHORITIES.
	°	'	"	°	'	"	
SAL or SALT ISLAND: [1]							
The North Point.....	16	51	0	22	58	30	The Survey of the Cape Verde Islands, by Lieutenants Vidal and Mudge, R.N.; taken by order of the Lords Commissioners of the Admiralty, in the years 1819, 1820, and 1821.
The South Point.....	16	34	0	23	0	0	
BONAVISTA:—							
The N.W. Point	16	13	20	22	59	40	
The N.E. Point.....	16	11	0	22	46	30	
The New Town.....	16	7	0	22	59	30	
The South Point.....	15	57	0	22	52	40	
Leton Rock.....	15	48	0	23	13	0	

CAPE VERDE ISLANDS CONTINUED.

	LAT. N.			LONG. W.			AUTHORITIES.
	°	'	"	°	'	"	
MAYO, or ISLE of MAY: [2]							
The North Point.....	15	19	0	23	16	0	The Survey of the Cape Verde Islands, by Lieutenants Vidal and Mudge.
English Road	15	7	30	23	17	0	
South Point	15	6	40	23	14	0	
ISLAND of ST. IAGO:							
Bighude or North Pt.	15	19	30	24	49	30	REMARKS. In the former editions of this work, we gave a detail of the observations, made at different times, for determining the situation of the Cape Verde Islands; particularly those made by Messrs. Fleurieu, Borda, Verdun, &c., by Mr. R. Keilor, Captains P. Heywood, Mortlock, &c. The results, generally, in regard to longitude, placed the islands a few minutes more to the eastward. We then gave Porto Praya in 23° 30' 34", now given in 23° 34' 0": the Road of Bravain 24° 45' 55", now 24° 47' 30": but to the western side of St. Antonio we assigned 25° 25', since confirmed, not only by the Admiralty Surveyors, but by Captain Monteath and other observers.
East Point.....	15	0	30	23	29	0	
Porto Praya.....	14	53	40	23	34	0	
S.W. Point	14	58	30	23	47	0	
ISLAND of FOGO:							
North Point.....	15	1	15	24	25	0	
Town of N.S. da Luz	14	53	0	24	34	0	
BRAVA:							
Road on the West side	14	48	0	24	47	30	
ST. NICOLAS:							
East Point	16	34	30	24	3	0	
North Point	16	42	0	24	24	20	
West Point	16	38	0	24	30	0	
South Point	16	28	30	24	22	0	
RAZA; East Point.....	16	38	0	24	38	30	
ST. LUCIA:							
East Point.....	16	46	0	24	45	0	
North Point.....	16	49	0	24	50	30	
ST. VINCENT:							
Porto Grande.....	16	54	0	25	4	0	
ST. ANTONIO: [3]							
North Point	17	12	0	25	9	20	
West Point.....	17	4	0	25	25	45	
South Point	16	55	0	25	22	0	
East Point.....	17	5	30	25	2	40	

NOTES.

1. SAL.—A particular description of Sal and all the other islands will be found in our third section, hereafter.

2. MAYO.—In the course of the year 1819, while surveying the island Mayo, Lieuts. Vidal and Mudge found the hills upon which they were carrying on their operations so strongly magnetic that the needle belonging to the theodolite became wholly useless; the dip increasing so much that the needle could not traverse, in consequence of one end of it being drawn down to the face of the instrument, &c.

3. ST. ANTONIO.—Captain Krusenstern, in the relation of his voyage around the world, says, "On the 6th of November, (1803,) at day-break, we perceived the island of St. Antonio, at the distance of from 25 to 28 miles. As the wind was moderate, I held directly to the westward, to keep still more away from the land, as calms are very frequent in the neighbourhood of lofty islands. At noon we had an observation in 17° 55' latitude. The S.W. point of the island bore, at that time, S. 24° E., distant about 45 miles. I now steered W.S.W., and, as the wind freshened towards the evening, S.W. by W. The next day, at noon, the S.W. part of the island St. Antonio bore 86°, distant about 54 miles; and I again held S.S.W.

"The mean of a variety of lunar observations, taken this morning, made our longitude, reduced to mid-day, 26° 17' 7". By the watches it was 26° 24' 40". I reckoned the longitude of the S.W. point of St. Antonio, by Arnold's large time-piece, No. 128, the best of our chronometers, 25° 24' 0". (Mr. Hoppner's Translation, page 53.)

Captain Flinders, in the relation of his voyage, (Vol. I. p. 26,) has said, that he found the variation near the western side of St. Antonio, in the evening of the 14th August, 1801, before making the land, $13^{\circ} 51'$; and in the next evening, $13^{\circ} 3'$, when four leagues to the westward. He had not an opportunity of making observations to determine the situation of the island, but, according to his estimation, it would appear to be even more to the *eastward* than the situation now assigned; as he supposed the high land near the S.W. point to be in $25^{\circ} 12' W$.

For further information, see the Chart of the Cape Verde Islands, *Second Edition*, published by the proprietor of this work, and see, also, the description of St. Antonio, hereafter.

VARIATIONS.—In 1821 the Variation of the Compass near St. Antonio was found to be near 16 degrees: at Port Praya, St. Iago, 14° West. The *mean* variation allowed by Lieuts. Vidal and Mudge is 14° .

9. GREENLAND, LABRADOR, AND NEWFOUNDLAND.

	LAT. N.			LONG. W.			AUTHORITIES.
	°	'	"	°	'	"	
GREENLAND.							
Staatenhuck, or Staten Hook..	59	30	0	43	0	0	Inferred from a sight of Staten Hook, by Captain Parry, in the Hecla, 15th June, 1819.
Cape Farewell [1]	59	45	0	46	20	0	
LABRADOR.							
Button's Isles, middle [2]	60	35	0	65	20	0	Connaissance des Tems, &c.
Port Manvers, entrance [3]...	57	0	0	61	55	0	Captain T. Manby, R.N., 1808.
Nain, a Moravian settlement..	56	24	0	61	48	0	Inferred from Port Manvers.
Huntingdon Island, at the } Entrance of Netsbucktoke, } or Sandwich Bay.....	53	50	0	56	30	0	Lane's Survey of Labrador.
Cape Charles	52	12	18	55	31	1	
Great Mecatina Point.....	50	44	28	58	59	27	Astronomic Observations of the British Surveyors, 1822.
Belle Isle, N.E. End of,.....	52	0	33	55	11	20	
———— S.W. End of,.....	51	52	26	55	19	31	
NEWFOUNDLAND.							
Cape Bauld [4].....	51	39	45	55	27	50	M. Grandchain, by chronometer, under an order of the French government, 1784.
Bay of St. Lunaire	51	28	57	55	30	0	
Croc Harbour	51	3	17	55	50	0	
Funk or Penguin Island [5]..	49	44	21	53	7	20	The Admiralty Surveyors, 1819 to 1822.
Green Island in Rocky Bay ...	49	29	0	54	7	0	
Ragged Point	49	30	0	53	54	0	
Deadman's Point.....	49	25	18	53	37	30	
Outer Cat Island.....	49	23	25	53	32	20	
Freels' Gull Island.....	49	19	6	53	20	58	
Charge Rock (6 feet)	49	18	0	53	17	10	
Stinking Islands	49	13	40	53	16	20	
Shoe Cove Point.....	49	4	40	53	31	30	
Offer Gooseberry Island.....	48	58	20	53	27	0	

GREENLAND, LABRADOR, AND NEWFOUNDLAND,

CONTINUED.

	LAT. N.			LONG. W.			AUTHORITIES.
	°	'	"	°	'	"	
Malone's Rock	48	53	30	53	24	40	The Admiralty Surveyors, 1819 to 1822.
Great Black Island, centre of, ..	48	50	8	53	32	15	
Little Denier Island	48	40	50	53	30	50	
Western Head	48	37	15	53	22	0	
Southern Head	48	37	15	53	16	0	
Young Harry Reef	48	48	5	52	58	15	REMARKS.
Bonavista' Gull Island	48	42	40	52	52	20	
North Head, Catalina	48	32	28	52	56	6	We have been favored, by a friendly hand, with the positions as given in the Table; but are not yet acquainted with the detail of observations on which they are founded. In our former editions we deduced the longitudes of the S.E., and South coasts, from the observations and Surveys of Capt. Jas. Cook, Lieut. M. Lane, Messrs. Cassini, Verdun, Borda, Pingré, and Owen; and these were generally, from 8 to 3 minutes eastward of those now given in the Table: but the longitude of the Burgeo Isles [<i>Eclipse I.</i>] remains as given by Captain Cook; and that of St. Pierre may, also, be considered as the same. Our space allowing it, we here subjoin the previous statement.
South Head, Catalina	48	27	38	53	0	52	
Horse Chops	48	21	30	53	8	30	
Entrance of Trinity Harbour ..	48	21	30	53	16	50	
Bonaventure Head	48	16	30	53	18	10	
Bacalieu, North Point of, ...	48	9	1	52	44	46	
Cape St. Francis	47	48	4	52	43	41	
St. JOHN'S Church [6]	47	34	35	52	38	37	
Cape Spear	47	30	53	52	53	27	
Bull Head	47	18	1	52	41	19	
Cape Broyle, North Point of, ..	47	3	52	52	47	27	
Cape Ballard	46	46	46	52	53	23	
CAPE RACE	46	39	44	52	59	9	
Cape Pine	46	37	14	53	30	2	
St. Mary's Cape	46	49	25	54	8	45	
Placentia Harbour	47	15	11	53	55	3	
Little Southern Harbour	47	43	32	53	54	38	
Extremity of Placentia Bay	47	49	46	53	57	14	
Bordeaux Harbour	47	45	28	52	58	30	
Cape Chapeaurouge	46	54	19	55	20	31	
St. Pierre, lighthouse [7]	46	46	52	56	8	44	
Cape Miquelon	47	8	11	56	19	30	
Connaigre shoal	47	23	57	55	57	19	
Pass Island	47	29	2	56	11	13	
Cape La Hune	47	31	55	56	50	23	
Outer Penguin Island	47	22	9	56	58	7	
Eclipse Island	47	36	6	57	36	15	
CAPE RAY	47	37	3	59	17	2	
Cape St. George	48	28	54	59	14	26	
South Head	49	6	12	58	20	32	
Cow Head	49	55	12	57	51	16	
Point Ferolle	51	1	9	57	5	47	

NOTES.

1. CAPE FAREWELL.—In the maps and charts, in general, the name of Cape Farewell is attached to the southern point of the continent of Greenland. In the Dutch charts, which have been republished in London, the same name is applied to an island, at the assumed distance of 45 leagues W.N.W. from that point. Hence, one point has frequently been mistaken for, or blended with, another: and this affords, therefore, one reason for the discordant accounts of longitude, &c.

The longitude of Cape Farewell has been stated, in the Tables of the French Nautical Almanac, the *Connaissance des Temps*, as well as in the English Tables, as $42^{\circ} 42'$; but, in the French Almanac for 1821, the position is given as $59^{\circ} 42' N.$; and, by chronometer, $45^{\circ} 16' 15'' W.$ (from Greenwich.). The lunar observations of Captain Upton, commander of the *Sybilie*, gave, however, $47^{\circ} 50' W.$; and this position we formerly adopted, on the recommendation of Captain Hurd, Hydrographer to the Admiralty.

But,

But, if the land of Staten Hook, bearing North, was seen, as we presume that it was, by Captain Parry, in the *Hecla*, 15th June, 1819, this would place Staten Hook in long. 43° , as in the Table, and considerably to the eastward of the longitude latterly assigned. Add to this the assumed difference between the two points, and this will show how the given longitude of Cape Farewell has been obtained.

It is much to be regretted, after all our expeditions to the North, that we should yet be ignorant of the true situation of Cape Farewell, &c.

2. **LABRADOR.**—For the formation of icebergs on this coast, which are so often met with to the southward, see our 'MEMOIR,' &c. on the Northern Ocean, page 43.

3. **PORT MANVERS**, formerly called Saltpetre Haven, was visited and explored by the *Thalia* and *Medusa* frigates, which wooded and watered here, in August, 1808. The islands in the vicinity are those formerly called the *Sadel Isles*. Of the mode in which the longitude was determined we have not yet been informed. The coast, as well as that of Greenland, now appears more to the westward than it was formerly represented.

4. **CAPE BAULD, &c.**—The positions given in the Table, are those given in the Requisite Tables, &c. They exactly correspond with the charts; but the British Surveyors, from their late observations, give Cape Bauld in $51^{\circ} 38' 31''$ N. and $55^{\circ} 18' 47''$ W.

5. **FUNK ISLAND** is little more than a low sterile rock, and cannot be seen at more than 10 or 12 miles off. It may be easily known by the great number of sea-birds constantly hovering round. A ledge of rocks is said to lie 7 miles to the S.W. of it, and there are several rocks to the northward.

6. **ST. JOHN'S, &c.**—Fort Amherst, noticed in the preceding Remarks, stands on the South Head, at the entrance of the Harbour.

7. **ST. PIERRE'S.**—The longitude of the town of St. Pierre was established, by chronometers, in the voyage of *La Flore*, Messrs. Verdun, Borda, and Pengré, 1771-2, and confirmed by the previous determination of the Burgeo Islands, by Captain Cook, from a solar eclipse, in August, 1766. (*Phil. Trans.* 1767.)

VARIATIONS OF THE COMPASS.—The variation off Cape Farewell, as found by Captain Ross, in 1818, was from 46 to 47° W. In the middle of the entrance of Baffin's Strait, 48° . At Port Manvers, on the coast of Labrador, Captain Manby found it to be 40° in 1808. It decreases thence to the southward. Off Cape Charles the Admiralty Surveyors have lately given it as 34° ; off Cape Bauld $31^{\circ} 54'$; at St. John's 29° . St. Pierre 27° ; Cape Ray 24° ; Cow Head 29° : but we apprehend that this is rather more than the true variation at the present time, if we may judge from former results; all of which represent it as 4 or 5 degrees less: but the Surveyors say that the variations near the coast, in several places, appear to be greater than those at sea; which is attributed to local magnetic attraction.

10. GULF AND RIVER OF ST. LAWRENCE, WITH BRETON ISLAND.

	LATITUDE.			LONGIT. W.			AUTHORITIES.
	°	'	"	°	'	"	
QUEBEC [1].....	46	47	30	71	10	0	{ Messrs. Lotbiniere, Bedard, and Holland.
ISLAND OF ANTICOSTI,							
West Point.....	49	47	0	—	—	—	{ The Observations of Mr. Thomas Wright, &c. (See next page.)
North Point.....	49	52	0	—	—	—	
S.W. Point [2].....	49	22	0	63	42	30	
South Point.....	49	4	0	—	—	—	
East Point.....	49	8	0	61	57	20	

GULF AND RIVER OF ST. LAWRENCE, &c., CONTINUED.

	LATITUDE.			LONGIT.			AUTHORITIES.
	°	'	"	°	'	"	
NEW BRUNSWICK, &c.							
Cape Gaspé (Rock off).....	48	41	0	64	7	40	The Observations of Mr. Thomas Wright, Surveyor-General of the Island of St. John, now Prince Edward Island, between 1769 and 1790, compared with the Government Surveys of Lower Canada, those of M. Des Barres, &c.
Bonaventure Island.....	48	29	0	—	—	—	
Point Miscou.....	47	58	0	—	—	—	
Point Escuminac, at the Entr. of Miramichi.	47	0	30	64	38	30	
Cape St. George (formerly Louis)	45	51	30	61	51	0	
The north End of the Gut of Canso.....	45	43	0	61	28	30	
PRINCE EDWARD ISLAND.							
East Point.....	46	26	30	—	—	—	Mr. Thomas Wright, &c.
CHARLOTTE TOWN.....	46	14	0	62	56	0	
Cape North.....	47	3	0	—	—	—	
BRETON ISLAND.							
Cape North [3].....	47	3	0	60	19	20	Mean of the Position assigned by Messrs. Wright, Des Barres, and Backhouse.
Siboux Isles, at the Entr. of St. Anne's Bay.....	46	24	20	60	26	30	
Scatari Island, off C. Breton	46	1	30	59	40	0	
Louisbourg [4].....	45	54	20	59	55	30	Ditto, by Messrs. Chabert and Des Barres.
Albion Cliff (S. side of Isle } Madame).....}	45	28	12	61	1	0	M. Des Barres.
Ship Harbour, in Gut of } Canso.....}	45	36	24	61	20	25	Mean of the Positions assigned by Messrs. Chabert and Des Barres.
TheMAGDALEN ISLANDS,&c.							
Brion Isle.....	47	52	0	—	—	—	Messrs. Wright and Haldimand. (<i>Phil. Trans.</i> 1768.)
Northern Bird Island.....	47	54	30	—	—	—	
Entry Island.....	47	16	0	61	26	0	
St. Paul's Island.....	47	11	0	—	—	—	Mr. T. Wright.

NOTES.

1. QUEBEC.—“The latitude of Quebec is $46^{\circ} 47' 30''$, according to the observations of M. le Marquis de Lotbiniere, M. Bedard, Director of the Seminary of St. Louis, and Captain Holland. M. Mechain computed the longitude to be $71^{\circ} 10'$, by several eclipses of Jupiter's first satellite, observed by Messrs. Lotbiniere and Holland; and the passage of Venus that Captain Holland observed in 1769. All these observations, made at different times, have given very coherent results.” *Vide American Trans.* Vol. I. &c.

The above passage, from “Analysis of a General Chart.” &c. Paris, 1786, shows the position in which Quebec has been hitherto laid down on the charts; and agrees with that given, to the present time, in the *Conn. des Tems*. But Quebec has been lately exhibited considerably more to the eastward, we believe erroneously. Mr. Smyth, in his Map of Upper Canada, has it $69^{\circ} 52'$; the error is here enormous. Mr. Wright, in his last publication, $70^{\circ} 27'$. The Requisite Tables give it in $71^{\circ} 5' 29''$. Mr. Bouchette, in his work on Canada, 1815, gives the situation of Quebec as $46^{\circ} 48' 49''$ N. and $71^{\circ} 11'$ W.

2. ANTICOSTI.—In his chart, Mr. Wright represents the S.W. point 19 minutes more to the eastward. In several other points his chart differs from the observed positions stated in his table. M. Des Barres, in his general chart, places the S.W. point 8 minutes more to the West. See the New Chart of the Gulf of St. Lawrence, constructed by the editor, and published by Mr. Laurie.

Mr. Bouchette, in his late Description of Lower Canada, has stated that the position of Anticosti is as follows:—East point, lat. $49^{\circ} 5'$, long. $62^{\circ} 0'$; the West point, lat. $49^{\circ} 48'$, long. $64^{\circ} 35'$; and the S.W. point, lat. $49^{\circ} 23'$, long. $63^{\circ} 44'$. We, however, take

take the liberty of stating that, we still believe the position given in the Table to be more correct. It is necessary to mention this, although the difference be small, because the latest authorities are too frequently depended on without sufficient reason; and it is to be noticed that, Mr. Bouchette has not described the multifarious authorities which must, necessarily, have been consulted and made use of in the compilation of his valuable Work. Such a Memoir would have proved highly honourable to the memory of his predecessor, in the office of Surveyor-general, the late Samuel Holland, Esq., whose genius and activity laid the basis of all future surveys of this part of the world, in his Map of New Hampshire, Charts of New England, Surveys of Lower Canada, &c.; the whole of which were adjusted, not only by correct bases, but by astronomic observations, that produced determinations remaining unquestioned to the present day.

Anticosti, through its whole extent, has neither bay nor harbour sufficiently safe to afford shelter to ships: it is uncultivated, being generally of an unpropitious soil, upon which any attempted improvements have met with very unpromising results; yet, rude and inhospitable as its aspect may be, it is not absolutely unprovided with the means of succouring the distress of such as suffer shipwreck on its coasts; there being two persons who reside upon it, at two different stations, all the year, as government-agents, furnished with provisions for the use of those who have the misfortune to need them. Boards are placed in different parts, describing the distance and direction to these friendly spots: these establishments were made in the year 1809; the humane intention of which will be honoured wherever it is made known, because the crews of vessels driven on shore here have, sometimes, at the utmost peril of their lives, forsaken them, to make their escape to Gaspé.—*Bouchette's Canada.*

One of these provision-posts is at two leagues to the S.E. from the west end of the island, in Ellis's Cove, or Grand Bay: the other is in Shallop Creek, three leagues to the W.N.W. from the south point of the island.

3. BRETON ISLAND.—Here the Admiralty surveyors give the longitudes rather more to the West. Cape North in $47^{\circ} 2' 5''$ N. and $60^{\circ} 22' 35''$ W. Sydney church in $46^{\circ} 8' 29''$ N. and $60^{\circ} 11' 28''$ W.

4. LOUISBOURG.—The longitude of Louisbourg ($59^{\circ} 55'$) was observed by the Marquis de Chabert, in 1750, as was, also, that of Ship Harbour, in the Gut of Canso ($61^{\circ} 20'$). These correspond so nearly with the position assumed by M. Des Barres, 1775, as to incline one to imagine that he may have adopted M. Chabert's determinations.

VARIATION OF THE COMPASS.—It has been proved, by numerous observations, made by the American surveyors, Messrs. Jos. and B. Ellicott, that the westerly variation, in 1800, ceased at or very near the River Niagara, on the south side of Lake Ontario, or longitude 79° W. See the particular plan of the Frontier of Niagara, given on the New map of Canada, &c. published by Mr. Laurie. The variation at Montreal was $7^{\circ} 45'$ W. in 1814. At the same time it was $11^{\circ} 50'$ W. at Quebec, and $15^{\circ} 10'$ off Green Island. In the year 1767, it was $19^{\circ} 20'$ off the N.W. end of Anticosti, and is still nearly the same. More to the southward, in the mouth of the river, it is 18 degrees. At Bonaventure, in Chaleur Bay, it was 17° in 1814. Near the island of St. Paul, between Newfoundland and Breton Island, it is, at present, about $20\frac{1}{2}$ degrees. Thence it increases to the eastward to Miquelon, &c., but it diminishes to the westward. In Sydney River, (Breton I.) it is 21 degrees; and, at Cape Breton, 22 degrees.

Mr. Bain, in his '*Essay on the Variation of the Compass*,' has noticed a frequent and remarkable aberration, which has been found on approaching the vicinity of Cape Chat. He says, "In the River of St. Lawrence, the change in the variation should be most particularly attended to, as it leads a ship, both in going up and coming down, on the coast most to be avoided." Mr. B. has shown that, in coming down, in May 1813, he found it necessary to steer a different course from the opposite one followed in going up, under very similar circumstances, a few days before. The difference exceeded a point. Both in going up and down, there was a breeze of 8 and 9 knots, weather uncommonly fine, and every circumstance extremely favourable for remarks.

Subsequent to the above period, the Zealous, ship of war, had a very narrow escape in going up the river. The compasses in the binnacle being so much affected by local attractions, that, had the fog not cleared away at the moment it did, the ship must have run on shore, not far from Cape Chat, she being in 19 fathoms.. See, farther, the new Book of Directions for Newfoundland, &c., published by Mr. Laurie.

11. NOVA SCOTIA, &c. (SOUTHERN COASTS.)

	LATITUDE.			LONG W.			AUTHORITIES.
	°	'	"	°	'	"	
ISLE OF SABLE. [1]	—	—	—	60	1	20	The OBSERVATIONS of Jos. F. W. Des Barres, Esq., made pursuant to the orders of the Admiralty of Great Britain, with a few subsequent emendations.
The East End	44	0	0	—	—	—	
The Southernmost Part.	—	—	—	60	32	30	
The West End	45	20	45	61	15	20	
Crow Harbour, in Chedabucto Bay (<i>Rook I.</i>)	45	19	15	60	56	0	
Cranberry Isl. <i>Lighthouse</i> [2]	45	18	10	60	56	50	
Cape Canso	45	21	0	60	59	40	
Canso Harbour, [3]	45	20	0	60	57	0	
Northern Entrance	45	13	30	61	3	15	
Southern Entrance	45	11	10	61	18	40	
Point Gell, near Raspberry Harbour [4]	45	5	20	61	40	28	
Berry Head, on the West side of Torbay	44	59	2	61	58	40	
Cape Mocodome, on the S.W. of Country Harbour [5] ..	44	56	40	62	2	0	
White Point, on the W. side of Liscomb Harbour	44	48	25	62	33	15	
Mariet-Joseph	44	44	0	62	41	15	
Cape Spry	44	42	0	63	4	8	
Heron I. near Keppel Harbour	44	30	0	63	31	0	
Jedore Head, W. side of Jedore Harbour	44	34	25	63	55	30	
SAMBRO' LIGHTHOUSE, near HALIFAX HARBOUR [6] ..	44	27	35	63	58	30	
Holderness Island, on the S.W. side of Margaret's Bay	44	23	25	64	5	10	
Green Island, off Mahone Bay	44	15	0	64	17	0	
Cross Island, off Lunenburg Harbour	44	10	30	64	29	0	
Cape Le Have	44	5	0	64	35	0	
Port Medway, S.W. Head of, <i>Coffin's Island Lighthouse</i> , near Liverpool Harbour [6]	43	57	30	64	42	0	
Mouton or Matoon Island ..	43	51	10	64	51	20	
Point Hebert	43	40	30	65	12	35	
Shelburne or Cape Roseway, <i>Lighthouse</i> [6]	43	32	5	65	17	30	
Cape Negro	43	26	0	65	34	30	
Cape Sable [7]	43	24	15	65	22	0	
Brasil Rock [7]	43	26	35	65	58	30	
Seal Island, South Point	43	51	30	66	10	30	
Cape Fourchu, near Yarmouth	44	12	0	66	14	0	
Cape St. Mary	44	20	0	66	19	0	
Brier's Island, <i>Lighthouse</i> [8]	44	45	30	65	45	30	
Point Prim, <i>Lighthouse</i> (Entr. of Annapolis Basin) [9] ..	45	22	40	64	20	0	
Cape Split, in the Mines Channel	45	22	0	64	49	30	
Cape Chignecto	45	27	0	64	43	0	
Apple River, Entrance	45	50	20	64	8	30	
Cumberland, Fort	45	18	27	65	58	45	
St. John's New Brunswick, Pt. Maspeck, on the E. side [10]							

NOTES.

1. **SABLE ISLAND.**—On this island there is an establishment for the relief of shipwrecked mariners, similar to that of Anticosti; described in Note 2, page 29. For the particulars, see the Book of Directions for Newfoundland, &c. page 75.

This establishment was founded in 1803, by the Provincial Legislature, at the recommendation of the late Sir John Wentworth, then Lieut.-Governor, and has since proved the means of saving many lives. In every year vessels are lost. The years 1822 and 3 were particularly marked; as from *L'Africaine* (French frigate,) the ships *Hope* and *Marshal Wellington*, 429 persons were saved, who, after escaping the dangers of the surf, would otherwise have perished with hunger. The superintendent and four men live on the island, supplied with good boats and provisions. The isle is visited twice in a year, by a vessel from Halifax. [The *bearings* in the following description are by compass.]

There are three houses on the island; of which one is occupied by the superintendent, and stands on the north side, at *eight miles*, (*nautic*) from the west end; the next is on the north side, at *four miles* from the western extremity, and *two and a quarter* eastward from the west end of the lake, and *four and a quarter* miles W.N.W. from the superintendent's; the other house, uninhabited, is on the South side, at *nine miles* from the East end, close to the eastern extremity of the lake, and *seven and a half* miles E.S.E. from the superintendent's. These houses are not in sight from the beach, but at 300 or 400 yards from it, and at the same distance also from the margin of the lake. Those uninhabited, contain provisions, tinder-box, matches, &c. There are several fresh water-ponds, as shown on the particular chart, but wherever the surface is moist, fresh water may be obtained by digging from one to three feet deep.

The N.W. BAR now extends *fifteen miles* to the N.W. from the west end of the island. The whole of it breaks in bad weather. The bank to the west and this bar appear to be still increasing. The Tide on the Bar sets North, slacks at half-flood, and turns to South before high water: its rate is two knots. The soundings hereabout are particularly irregular to the N.W. and N.N.W. with very variable currents.

The N.E. BAR extends *seven leagues* E. by N., and is about two miles wide. This Bar appears to be travelling North. In gales of wind the whole of it appears like one line of breakers, but in more moderate weather they do not extend beyond *fourteen miles*, and a vessel may cross at *sixteen miles* in 7 fathoms. The flood-tide here sets N.N.E. at the rate of 5 knots; the ebb 3 knots or less, and is scarcely felt with a spell of South and S.W. winds.

Strong gales cause annual shiftings of the sand on both bars, which, in the course of years must alter their form and extent. Mariners approaching the isle are warned to keep the lead going, and never to approach the South side nearer than 10 fathoms, nor the North side nearer than 25 fathoms. On the South side, the CURRENT, in shoal water, with prevailing South and S.W. winds, sets rapidly eastward, until it reaches the end of the N.E. Bar; it then unites and blends with the St. Lawrence' Stream, which passes the bar in a S.S.W. direction, and runs strongest in April, May, and June. Mr. Darby says, I have sufficient reason for believing that the Gulf-Stream on the parallel of $42^{\circ} 30'$, running E.N.E., occasions the St. Lawrence' Stream, then running S.S.W. to glide to westward. The strength of this stream has never been noticed, and three fourths of the vessels lost have imagined themselves to the eastward of the island, when, in fact, they were in the longitude of it. On the north side of the island the currents are variable, but mostly eastward.

The SOUNDINGS decline regularly on the South side of the island only; on approaching it from any other bearing whatever, comparatively deep water will be found, as 10 fathoms or more, close to danger. In foggy weather, vessels should not approach the North side, or point of either bar, nearer than in 25 fathoms. Two belts encircle the isle; the outer, at a mile from shore, has $2\frac{1}{2}$ fathoms on it. These belts are increased by gales and high winds, which, raking the island, drift the sand from them to the Bars. The island being composed of loose light sand, high gales frequently alter its outline and appearance.

Should a vessel happen to be ashore in a fog, situation unknown, lower a boat, when prudent, and observe the following notice:—If breakers extend N.W. and S.E. you are

on the N.W. Bar : if they extend W.S.W. and E.N.E. you are on the N.E. Bar : if they extend a-head North, and then lie E. and W., you are on the South side : if South, and then lie E. and W., you are on the North side.

The prevailing winds about the island are from E. to S. and from S. to W. With these the North or leeward side is comparatively smooth, and, therefore, should be sought. There is a swashway on each bar, shown on the chart, and lives may be saved by passing through, and thus getting to leeward. There is no risk in moderate weather, but if the surf should appear too dangerous, land as you can, or try to weather the bar altogether. Having once got to the northward of the bar, haul up S.E. or W.S.W., as the case may be, for the land, and take the boat ashore as near the house as may be convenient. The semi-circular form of the North side is favourable for boats, as under the windward curve a lee is afforded from East and West winds ; but, with a fresh north wind this form is against a boat getting off the land : therefore, if ashore, on the North side, push the boat right before the sea for the land, rather than risk getting to leeward by crossing either bar.

If ashore on the South edge of either Bar, with the wind North, land on the South side.

If ashore on the N.E. Bar in tolerable weather, with the wind about West, you may land at the east end without crossing the Bar ; and *vice versa*, if on the N.W. Bar, and, owing to the inner belt, the time of high water is the best for landing.

After landing, if, owing to a fog, you cannot judge of your situation, so as to shape your course to one of the houses, seek the lake and then proceed.

The preceding description, excepting a little alteration, is from the observations of Mr. Joseph Darby, master of the schooner *Two Brothers*, and ten years in the service of the island. (Halifax, 8th April, 1824.) For M. Des Barres' description, see '*Colombian Navigator*,' Vol. I. pages 1, 2.

2. CRANBERRY ISLE, near Cape Canso.—The first notice of the lighthouse on this isle was given by Mr. Ant. Lockwood, in his description of Nova-Scotia, 1818. This gentleman observes that, 'the Gut of Canso will, by its means, become the common gateway to the Gulf and River of St. Lawrence, and will tend to mitigate the rigors of a late or early passage to Quebec.'

Mr. Lockwood represents the lighthouse in $45^{\circ} 21' 5''$ N. and $60^{\circ} 58' 10''$; which, it may be observed, is $1' 50''$ to the northward of M. Des Barres' latitude, and a little more to the west.

Of the numerous rocks hereabout, the outer breaker, called the Bass, a rock of 3 feet water, lies more than two miles E. $\frac{1}{2}$ S. by compass [$E. 13^{\circ} N.$, true,] from the lighthouse on Cranberry Island.

3. CANSO HARBOUR is the harbour, or rather channel, formed by George's, formerly Canso, Island. M. de Chabert, in 1750, stated this harbour to be in $45^{\circ} 20' N.$ and $60^{\circ} 55' W.$ The latitude here agrees with M. Des Barres, and the longitude is only 3 minutes more to the east. Mr. Lockwood, on the contrary, makes the latitude $2'$ more North, and the longitude $2'$ more to the West.

4. RASPBERRY HARBOUR is the PORT HOWE of the charts of M. Des Barres.—We have noticed, in a former work, that the bulk and price of the showy work of this gentleman never suffered it to come into general use ; and, consequently, the new names which he assigned to different points and places have remained generally unknown. Mr. Lockwood says, "The original names of the places are restored, by which only they are known to the inhabitants and fishermen. Des Barres, in attaching to them the names of noblemen, or men in power, has made his charts of less value ; and, in one or two instances, has created serious blunders. Inquire of the people of Jedom for Port Egmont, or those of Sheet Harbour for Port North, they know them not ; nor would they ever be induced to adopt them. Jestico, a harsh, unpleasant, and unmeaning, name, is preferred to Port Hood, although the latter is more pleasing to the ear, and pronounced and recollected with ease : all attempts to change the rude Indian names for others of a finer texture have failed ; even New Jerusalem and Acadia have expired."

5. CAPE MOCODOME, &c.—This Cape is represented, by Mr. Lockwood, in $45^{\circ} 3' N.$ and $61^{\circ} 36\frac{1}{2}' W.$; and, in other instances, this gentleman's results differ from those of M. Des Barres ; but, as we are unacquainted with the nature of his observations, we cannot with propriety substitute them for the latter, of which the particulars are known.

6. HALIFAX, Lighthouse, &c.—Of the lighthouse, the situation, as shown by the Table, is $44^{\circ} 30' N.$ and $63^{\circ} 31' W.$ Mr. Lockwood gives it $44^{\circ} 28\frac{1}{2}' N.$ and $63^{\circ} 30\frac{1}{2}' W.$ It is satisfactory

satisfactory to find that the two so nearly agree. The lighthouse has seven lamps, and its lantern is elevated 210 feet above the level of the sea. A small party of artillery are stationed here, to attend to signals, with two twenty-four pounders, as alarm-guns: by the attention of these men several shipwrecks have been prevented.

There are two other lighthouses on the coast, westward of that of Sambro'; the first is on Coffin's Island, at the entrance of Liverpool Bay; the second on Cape Roseway, at the entrance of Shelburne Harbour. The positions are shown in the Table. Of these one may be distinguished from the other by noticing that the lantern of Sambro', exhibiting a *fixed* light, is elevated 210 feet, while the light on Coffin's Island is only 75 feet in height, the light *revolving*, and appearing full at intervals of two minutes: the lighthouse on Cape Roseway exhibits *two* lights, the upper light at about 150 feet above the level of the sea, and the smaller light at 36 feet below the lantern.

7. CAPE SABLE and BRASIL ROCK.—M. Chabert has given the position of the Cape as $43^{\circ} 23' 45''$ N. and $65^{\circ} 30' 0''$ W. Mr. Lockwood as $43^{\circ} 27' 40''$ N. and $65^{\circ} 33' 0''$ W.; we are not, therefore, inclined to alter the statement in the Table. The Brasil Rock, of 8 feet of water, lies S.E. by E. $\frac{1}{2}$ E. by compass [*E.S.E.*, $\frac{1}{2}$ E.] $8\frac{1}{2}$ miles from Cape Sable.

8. BRIER'S ISLAND LIGHT.—It should be known that the lighthouse, situate on the western side of Brier's Island, is so mean a one, and so badly kept, that it is by no means to be depended on. The light is about 92 feet above the level of the sea.

9. POINT PRIM LIGHTHOUSE.—This, also, is said to stand 'as a monument of mistaken economy.' The light is exhibited from a window, at 120 feet above the sea.

10. ST. JOHN'S HARBOUR.—For a description of the Lighthouse, &c. see the Directions above quoted, pages 92, 93.

VARIATIONS OF THE COMPASS.—In the year 1775, the Variations were given by M. Des Barres, as follow: North entrance of the Gut of Canso $16^{\circ} 0'$ W.: Crow Harbour, Chedabucto Bay, $14^{\circ} 50'$ W.: Entrance of Liscomb Harbour, 14° : Sable Island, $13^{\circ} 57'$: Halifax Lighthouse, $13^{\circ} 35'$: Entrance of Shelburne, $13^{\circ} 30'$: Cape Sable, $11^{\circ} 15'$. In 1798, Mr. Backhouse, of the navy, found the variation at Halifax to exceed 16 degrees; an addition of $2\frac{1}{2}$ degrees to the preceding may therefore give the present variation very near the truth. Mr. Lockwood gives the variation at Halifax $17^{\circ} 28'$, and at Cape Sable $14^{\circ} 27'$, but it seems that the needle is now *receding*. At St. John's, New Brunswick, the present variation is about 16 degrees.

12. FREDONIA, OR THE UNITED STATES.

	LATITUDE.			LONGITUDE.			AUTHORITIES.
	°	'	"	°	'	"	
MOUNT DESERT ROCK	43	52	0	68	3	30	The Surveys of New Hampshire, &c., and observations of the Surveyor-General, S. Holland, Esq., compared with observations made by M. Chabert, Dr. Williams, Dr. Winthrop, &c.
Isleboro' or Long Island, in the Bay of Penobscot. [1] A							
Point on the East side	44	17	7	68	45	0	
White Head, Lighthouse	43	59	0	68	58	15	
Portland Lighthouse	43	36	30	70	10	0	
Pyramid on Cape Elizabeth ..	43	34	0	70	9	0	
Cashes Ledge (12 feet water) ..	43	1	0	69	6	0	
Boon Island, Lighthouse	43	7	30	70	27	30	
Portsmouth [2]	43	4	15	70	43	15	
NEWBURY-PORT Lights	42	47	45	70	46	50	
Cape Anne Lights	42	37	20	70	33	0	The observations of the Members of the Philadelphian Society &c., (<i>Am. Trans.</i> Vol. I.) compared with the Topographic Surveys of Boston Harbour and the country adjacent.
Boston, Beacon Hill at, ...	42	22	38	70	59	45	
Boston Harbour Lighthouse [3]	42	20	36	70	49	10	
Cambridge, Town of, ...	42	23	28	71	4	0	
Cape Cod, High Lighthouse [3]	42	3	0	70	2	40	
PROVIDENCE, Town of [4]	41	50	41	71	25	20	

THE UNITED STATES, CONTINUED.

	LATITUDE.			LONGITUDE.			AUTHORITIES.
	°	'	"	°	'	"	
Montuk Point, East end of } Long Isl. (<i>Lighthouse</i>) [5] }	41	0	30	71	57	40	Inferred from the position of the Fort at New York, by Mr. De Witt's Survey. Governor Burnet, Mr. Ervin Prior, 1769, the observations of the King's Commissioners, &c. Deduced from Cape Henlopen. M. de Chabert, compared with the Provincial Surveys. The observations of Messrs. Mason, Dixon, and Prior, on the transit of Venus, 1769, with a subsequent correction. Dr. David Rittenhouse, late President of the Am. Ph. Soc., compared with Howell's Survey of Pennsylvania, De Witt's New York, &c. Lat. Captain Penrose, Lord Cochrane, and Mr. Downie, 1795: Longitude inferred from that of Washington, &c. Lat. Mr. Andr. Ellicott, Surveyor to the United States. For Longitude, see Note 12. Lat. Capt. Gascoyne: Long. inferred. Lat. Messrs. Wheatley and Dunbabin: Long. as above.
NEW YORK, the Fort of, [6].	40	41	25	74	5	13	
Sandy Hook, <i>Lighthouse</i> [7] ..	40	26	40	74	6	10	
Cape May	38	57	0	74	55	45	M. de Chabert, compared with the Provincial Surveys. The observations of Messrs. Mason, Dixon, and Prior, on the transit of Venus, 1769, with a subsequent correction. Dr. David Rittenhouse, late President of the Am. Ph. Soc., compared with Howell's Survey of Pennsylvania, De Witt's New York, &c. Lat. Captain Penrose, Lord Cochrane, and Mr. Downie, 1795: Longitude inferred from that of Washington, &c. Lat. Mr. Andr. Ellicott, Surveyor to the United States. For Longitude, see Note 12. Lat. Capt. Gascoyne: Long. inferred. Lat. Messrs. Wheatley and Dunbabin: Long. as above.
Cape Henlopen, <i>Lighthouse</i> [8]	38	46	40	75	8	15	
PHILADELPHIA, 'Christ- } church, in Second Street [9] }	39	56	54	75	10	30	
Norriton, Observatory [10] ...	40	9	56	75	23	30	Lat. Captain Penrose, Lord Cochrane, and Mr. Downie, 1795: Longitude inferred from that of Washington, &c. Lat. Mr. Andr. Ellicott, Surveyor to the United States. For Longitude, see Note 12. Lat. Capt. Gascoyne: Long. inferred. Lat. Messrs. Wheatley and Dunbabin: Long. as above.
Cape Henry, <i>Lighthouse</i> [11]	36	56	15	75	57	0	
WASHINGTON, Capitol [12]	38	53	0	77	0	20	
Cape Hatteras, <i>Lighthouse</i> [13]	35	7	50	75	38	15	Lat. Mr. N. Pocock, &c. Long. as above. Mr. Jas. Elford, of Charleston. Lat. M. Chabert: Long. as above. Mr. Ellicott, Commissioner from, and Surveyor to, the United States, 1800.
Cape Fear, <i>Lighthouse</i>	33	51	15	78	1	40	
Frying Pan or Cape Fear } Shoals, S. end	33	30	42	77	47	0	
George Town, <i>Lighthouse</i>	33	17	0	79	7	40	The Observations of Don José Joaquin de Ferrer, and other Spanish officers, compared with the Surveys of Messrs. Gauld, Romans, &c.
Cape Roman	33	4	0	79	19	0	
Charleston <i>Lighthouse</i> [14] ..	32	40	49	79	52	0	
Savanna, Tybee <i>Lighthouse</i> ...	32	0	41	80	38	40	The Observations of Don José Joaquin de Ferrer, and other Spanish officers, compared with the Surveys of Messrs. Gauld, Romans, &c.
Cumberland Island, South } end, <i>Lighthouse</i> [15]	30	43	15	81	35	30	
River Nassau, Entrance South Channel	30	28	0	81	33	30	
River S. Juan, Bar	30	21	0	81	32	30	The Observations of Don José Joaquin de Ferrer, and other Spanish officers, compared with the Surveys of Messrs. Gauld, Romans, &c.
St. Augustin, middle of the Bar	29	53	0	81	23	30	
Matanza Inlet	29	42	0	81	19	30	
Cape Canaveral, South Pt.	28	16	30	80	27	0	The Observations of Don José Joaquin de Ferrer, and other Spanish officers, compared with the Surveys of Messrs. Gauld, Romans, &c.
Cape Florida	25	41	30	80	5	0	
Sable Point, or Cape Sable	25	2	0	81	15	0	
DRY TORTUGAS, Middle Kay [16]	24	31	0	82	59	30	The Observations of Don José Joaquin de Ferrer, and other Spanish officers, compared with the Surveys of Messrs. Gauld, Romans, &c.
Tortugas Bank, Shoalest Part	24	25	0	83	12	0	
Balise or S.E. Entrance of the	24	25	0	83	12	0	
Missisipi [17]	29	5	27	89	8	0	The Observations of Don José Joaquin de Ferrer, and other Spanish officers, compared with the Surveys of Messrs. Gauld, Romans, &c.
.....	29	57	45	90	8	0	
.....	29	57	45	90	8	0	

NOTES.

1. ISLEBORO' OF LONG ISLAND, &c.—The position of this island was determined, in 1780, by Dr. Williams, Dr. Winthrop, and other American astronomers, from a total eclipse of the sun, Sept. 27. The longitude of Boston is at present given, in the Requisite Tables, as $70^{\circ} 37' 15''$. We presume that this was intended for $70^{\circ} 57' 15''$. The longitude of CAMBRIDGE has been computed by M. Mechain, from two solar eclipses of 1766 and 1778, with the transit of Venus in 1769. The latitude was determined by Dr. Williams, 1784.

2. PORTSMOUTH.—The longitude of Portsmouth, by four eclipses of the first satellite of Jupiter, was communicated to the Royal Society by Captain Holland, 1774, and is thus represented in the Requisite Tables, &c.

3. CAPE COD, &c.—The lighthouse, which has long stood at the Clay Ponds of Cape Cod, we now call the *High lighthouse*, since there is another on the Race Point of the Cape. The first is erected on land elevated about 150 feet, which, with the elevation of the lantern, makes the whole height 200 feet above high-water mark. The light, which was formerly revolving, is now fixed.

The low light on the Race Point was first lighted on the 5th November, 1816. This is a revolving light, and is, therefore, readily known from the light on the high land. The light cannot be seen until it bears, by compass, S. by W. $\frac{1}{2}$ W.

The LIGHT OF BOSTON HARBOUR, formerly fixed or steady, is now revolving: it appears brilliant 40 seconds, and is observed 20 seconds, alternately.

4. PROVIDENCE.—The longitude of Providence, as computed by M. Pingré, from the transit of Venus, 1769, and as it now stands in the Requisite Tables, is $71^{\circ} 22'$. This appears to be incorrect.

5. THE LIGHTHOUSE OF MONTUK OR MONTEAGUE Point exhibits a fixed light, as do all those within Long Island Sound, the whole of which are exhibited on the Chart of the Coasts from Cape Cod Bay to the Missisipi, recently published: but the light on Watch Hill Point, on the north side of the entrance, is revolving.

6. NEW YORK.—In the *Ladies' and Gentlemen's Diary*, or *United States' Almanac* for 1820, Mr. Nash, the Editor, who has the reputation of a clever man and excellent observer, gives particulars of a great many meridian and circum-meridional observations, taken at his School, Broadway, New York, from which, so far as we can judge, the latitude is most satisfactorily established for No. 331, Broadway, at $40^{\circ} 42' 58''$. 788. The difference of latitude, trigonometrically found, between Mr. Nash's and the City Hall, was somewhat less than 1300 feet; which, assumed as $13''$, gives the latitude of the City Hall as $40^{\circ} 42' 45''$, i. e. allowing $40^{\circ} 42' 58''$ as the latitude of No. 331, Broadway. By observations of a Solar eclipse, which Dr. Bowditch observed at New York, he found the difference of longitude between Greenwich and Colombia College, equal to $74^{\circ} 00' 45''$ W. "Within two years past, (says Mr. Nash,) I have made it from 3 to 5 minutes less, and 4, 5, and 8, minutes more. On the 29th May, 1818, at few minutes past noon, the longitude at No. 331, Broadway, by the mean of three distances of the Sun and Moon, was found to be $74^{\circ} 00' 42''$ W. But, since the longitude of places cannot be found precisely, unless by approximation from multiplied observations, I am inclined for the present to place the City Hall in 74° West."

7. SANDY HOOK.—The position has been given by M. de Chabert as $40^{\circ} 25'$ N. and $74^{\circ} 13' 15''$ W. In this instance both latitude and longitude appear to be erroneous. The Requisite Tables give $40^{\circ} 26' 30''$ and $74^{\circ} 6' 42''$. The longitude of New York, as given on M. De Witt's Survey of the Province, is $74^{\circ} 3'$; and this, in concurrence with our other documents, tends to prove that New York Harbour lies not farther to the west than is shown by the Table.

The lighthouse on Sandy Hook, exhibits a capital fixed light, which may, with attention, be discerned, in clear weather, at the distance of ten leagues. Notice was also given at New York, 18th July, 1823, that a *light-vessel*, having two masts, with a lantern on each, had been moored between six and seven miles to the eastward of Sandy Hook.

Lights are exhibited in each lantern from sun-set to sun-rise. The vessel is provided with a large bell and clock-work, which in stormy and foggy weather will be kept tolling at the rate of one stroke in a minute. Vessels from sea, making the light, and steering from it a course due West, may thus come to safe anchorage within Sandy Hook. Light-vessels are, however, so often driven from their stations, that much dependence on this, more than on any other, should not be allowed.

8. CAPE HENLOPEN.—The longitude, as given by M. de Chabert, is $75^{\circ} 12' 30''$, as now in the *Connaissance des Temps* and *Requisite Tables*. But the maps prove that this, also, is too far to the west. Vide preceding note.

9. PHILADELPHIA.—The original deduction of the longitude of Philadelphia was $75^{\circ} 13' 43''$, and of Norriton $75^{\circ} 28' 30''$, as now in the *Requisite Tables*; but we have given Norriton according to its distance from Philadelphia, by Mr. Howell's Survey.

10. NORRITON is an inland town, about 16 miles to the N.W. of Philadelphia, but celebrated for the observatory of the late astronomer Dr. David Rittenhouse. See note 22, "*Colombian Navigator*," Vol. I. p. xxii.

11. CAPE HENRY.—The result of observations made by Captain Penrose, Lord Cochrane, and Mr. Downie, of the British navy, in 1795, gave $76^{\circ} 16'$ as the longitude of Cape Henry. M. Chabert had previously placed it in $76^{\circ} 31\frac{1}{2}'$, as it now stands in the *Requisite Tables*. Admiral Espinosa's chart, of 1811, places it in only $75^{\circ} 46'$; Mr. De Mayne's chart (1820) in $75^{\circ} 47'$; and we have no longer any special reason for placing it to the westward of the meridian assigned in the Table.

12. WASHINGTON.—As inferred from the observations made at Cape Henry, Washington was formerly placed in $77^{\circ} 14'$ W. Dr. Bowditch's *Navigation*, 1817, and the '*American Coast Pilot*,' give it in $77^{\circ} 16'$, while every other modern document give it more to the eastward. We have already shown, in the '*Colombian Navigator*,' Note 25, Vol. I. page xxiii, the reasons for adopting $77^{\circ} 0'$ as the meridian, of Washington; and, by reference thereto, it will be found that the true longitude is rather to the eastward than to the westward of the same. The French Tables give it as $76^{\circ} 59'$.

13. CAPE HATTERAS, &c.—The correction of longitude, explained in the preceding note, continues and blends with that produced by the observations of Mr. Ellicott on Cumberland Island.

A light-vessel, of 330 tons, has lately been stationed off Cape Hatteras. It shows two lights; one at the height of 60 and the other at 45 feet, and is moored in a depth of 20 fathoms, with soundings of sand, shells, and clay. From the light-vessel, the light-house on Cape Hatteras bears N. $50^{\circ} 37'$ W. 11 miles, and the South Shoal S. $78^{\circ} 45'$ W. $4\frac{1}{2}$ miles. Here, with a south wind a current runs N.N.E. 2 miles an hour: and, with a north wind, S.S.W. 2 miles. The light vessel is so far from the Shoals, that vessels can pass, without risk, between them. The estimated distance from the boat to the Gulf-Stream is commonly about 30 miles.

The Schooner, Ella Kintzing, Frazier, master, fell in with the light-vessel, in the night of the 18th June, 1824, and the commander reported that, being new and unexpected, he paid particular attention to it: he represents that it has a very strong and splendid light; and he judges, from its having stood a very heavy gale, blowing nearly 24 hours from North to N.E., that it will answer every purpose intended.

14. CHARLESTON LIGHTHOUSE.—The light here was formerly *fixed*; but, in 1816, it was altered, and is now *revolving*. Since the alteration, the light may be seen to a great distance: Captain M'Neal, of the ship *Isabella*, says to the distance of ten leagues. —See *Colombian Navigator*, page xxiii.

15. CUMBERLAND ISLAND, &c.—It appears, upon examination, that Cumberland Island, with all the coast to the southward, was, previous to the year 1799, exhibited much too far to the westward, in all existing charts and maps. Some observations, by Mr. Charles Roberts, published so late as 1794, placed Cape Canaveral in $81^{\circ} 28'$, and Cape Florida in $81^{\circ} 13'$ West of Greenwich; or more than a degree to the westward of the longitude now assigned.

For the position given in the Table, we are indebted to the "*Journal of Mr. Andrew Ellicott*," commissioner on behalf of the United States, for determining the boundary of the

the Spanish possessions, during part of the year 1796, the years 1797, 8, 9, and part of 1800. Quarto, Philadelphia, 1803. The following are the results of the observations made for the longitude, at the South end of the island, in the year 1800.

		In Time.	H.	M.	S.
March	13. Emersion of the 1st satellite of Jupiter		5	26	29
	15. ————— 2d satellite		5	26	33
	17. Lunar Observation		5	26	59
	— Another Lunar Observation		5	26	25
	— A third Lunar Observation		5	27	25
	25. Emersion of the 3d satellite of Jupiter		5	26	14
	26. Emersion of the 4th, by the <i>Nautical Almanac</i>		5	51	48
	by Delambre's Tables		5	27	37
	27. Emersion of the first satellite of Jupiter		5	25	43
	30. Lunar Observation		5	26	6
April	1. Immersion of the 3d satellite of Jupiter		5	24	6
	Emersion of the same		5	26	0
	2. Emersion of the 2d satellite of Jupiter		5	26	49
	5. ————— 1st satellite		5	26	40
	9. ————— 2d satellite		5	26	57

Thus, ultimately, the longitude, in time, was concluded to be 5h. 26m. 22s. equal to $81^{\circ} 35' 30''$, and the latitude $30^{\circ} 43' 15''$. 8. Our plan does not admit of a farther detail of this important result. We give the example as one which, if repeatedly imitated on important points, would lead to incalculable improvements in practical geography.

The Spanish surveyors give the Bar of St. Mary's River in $30^{\circ} 45' N.$ and $81^{\circ} 32\frac{1}{2}' W.$ This, it may be noticed, corresponds very nearly with Commissioner Ellicott's determination, and it also accords with many meridional observations taken by Captain William Tulloch, of Portsmouth, in New Hampshire.

16. TORTUGAS and FLORIDA KAYS.—The general range of isles and kays, called the Martyrs, &c., have been adjusted in our charts by the latest editions of those of Spain, which have been verified by many English navigators: but, in the detail, we have followed the excellent survey of Mr. Gauld, made by order of the Lords Commissioners of the Admiralty, in the years 1773, 4, and 5. This fine specimen of nautical surveying has lately been adjusted conformably to the same documents.

17. ENTRANCE and LIGHTHOUSE of the MISSISSIPPI.—The new lighthouse stands on Frank's Island, North by compass, three miles from the Bar of the S.E. Pass, and in a situation not approved by the pilots. In consequence of a failure in the foundation, it was found necessary to pull down the stone and brick tower originally intended; and upon the base, a wooden superstructure has been erected, on which an excellent steady light is now exhibited.

The preceding information was communicated by Captain A. Livingston, who adds, "by meridional altitudes of the sun taken by me with a Troughton's circle and an artificial horizon, and by Mr. W. A. Somers, of Balize, with my sextant and the nautical horizon, we found the latitude of the Blockhouse (*Balize*) to be $29^{\circ} 7' 55''$, and that of the centre of the Bar, by the bearing and distance from the Blockhouse, to be $29^{\circ} 5' 27'' N.$

18. NEW ORLEANS, &c.—The position given in the Table was adopted by Mr. Gauld in his Survey of West Florida, made in the years 1764 to 1771, and first published, on four sheets, in 1803. The same position has been assumed by Mr. Darby, in his Survey of Louisiana, published in 1816; but the late Spanish charts give the longitude rather more to the eastward, and the *Connaissance des Temps* to 1825 gives it as only $89^{\circ} 58' 45''$. The chart of Admiral Espinosa, 1811, represents it as in $90^{\circ} 6' W.$

VARIATIONS OF THE COMPASS.—The following are the variations as given on the surveys of Samuel Holland, Esq. in 1775. It appears, from later works, that the variation in Massachusetts Bay, &c., is a degree less, at present, than when these observations were made.

Off Machias Bay, $13^{\circ} W.$: off Mount Desert Isle, $10^{\circ} 30'$; Bay of Penobscot, 10° ; near Isle Haute, 9° : near Manheigin Isle, and thence to Portland, $8^{\circ} 30'$: Portsmouth, $7^{\circ} 40'$.

7° 48': off Newburyport, 7° 40': Boston Bay, 7° 40': Plymouth Bay, 7°: between Nantucket and Martha's Vineyard, 6° 30': off Rhode Island, 6° W.

In New York Harbour it was 7° in 1776, and is still about half a point. Off the Delaware it is about 4 degrees. Off the Chesapeake we find the results extremely discordant; but it is there, probably, nearly the same.

The westerly variation appears to cease between Cape Hatteras and Cape Fear; to the southward of the latter the easterly variation commences. Off the Head of the Maternillo Bank, in latitude 28°, it was found to be 3° 23' E. in 1807.

In 1771, Mr. Gauld gave the Variation near the entrance of the Mississippi as 6° 37' E. Mr. Romans, nearly at the same time, found it, near the Bay of Espiritu Santo, to be 5° 47' E.; and, from observations made more to the southward, in and subsequent to 1807, we infer that it is, at present, nearly one degree more to the East. From six amplitudes taken by Captain Livingston, on his passage from and to New Orleans, in 1818, the Variation on the meridian of the Dry Tortugas, in latitude 23° 45', appeared to be 6° 33' E. In Lat. 25° 15', Long. 85° 20', 8° 20' E.: in Lat. 25° 55'; Long. 85½°, 9° 30' E.: In Lat. 26° 55', Long. 86° 15', 6° 49' E. We are not acquainted with the position of the ship's head at the time of observation, and, for this deficiency, due allowance must be made.

The discordance of numerous results of observations for variation on these coasts have occasioned the rejection of nearly one half of the number that have come to the hands of the Editor. That discordancy has undoubtedly arisen from the various positions, &c. of the ships in which the observations were made, as explained in the Appendix hereafter.

13. THE BERMUDAS' OR SOMMER'S ISLANDS.

	LAT. N.	LONG.	AUTHORITIES.
	° /	° /	
Wreck Hill, the Western extremity of the Land.....	32 15½	64 47	A number of lunar observations, taken by Capt. Hurd, who surveyed these isles, Lord Cochrane, Mr. Murdo Downie, and other officers, verified by good chronometers. The difference of the respective results, for longitude, seldom exceeded 5'; and it may, therefore, be concluded, that the mean here given is sufficiently exact.
The Long Bar, the South-western extremity of the Rocks	32 9	64 54	
The S.W. Breaker.....	32 10	64 45	
The Southern extremity of the Land	32 12	64 43	
St. David's Head, the Eastern extremity of the Land	32 22	64 31	
Catherine Point, the Northern extremity of the Land.....	32 23	64 33	The VARIATION of the Compass, as observed in 1803 and 1808, was from 2° 30' to 3° W.
TOWN of St. GEORGE	32 22	64 33	
North Rock, the Northern extremity of the Rocks.....	32 33	64 37	
Mill's Breaker, the Eastern extremity of the Rocks.. ..	32 27	64 30	

NOTE ON THE BERMUDAS.

The above was communicated, by Mr. Downie, for the service of the public, a few years since, to the Honourable Board of Trinity-House, London. It is to be particularly noticed, that, the position of these islands, as still given in the Requisite Tables, under the name of *Bermudas*, is very erroneous; being latitude 32° 35', and longitude 63° 28', or more than a degree to the eastward of their true place. But the town of *St. George* is stated, in the same Table, as in 32° 22' 20" N. and 64° 14' 15" W.

In answer to several enquirers, as to Captain Hurd's Survey, we can state only that it has not yet been published.

14. THE BAHAMA AND PASSAGE ISLANDS.

	LAT. N.			LONG. W.			AUTHORITIES.
	°	'	"	°	'	"	
MATERNILLO BANK, North End of	27	50	0	79	10	0	Spanish Surveyors.
Maternillo Reef, N.W. End, [1] ..	27	34	0	79	9	0	
Outer part of the Western Reef...	27	5	0	79	12	0	
Memory Rock.....	26	55	0	79	2	0	
West End of Grand Bahama I.....	26	41	0	79	1	0	
S.E. Point of Grand Bahama.....	26	28	0	78	40	0	
HOLE IN THE ROCK OR WALL [2]	25	50	0	77	7	0	
N.E. Point of Abaco.....	26	19	0	76	55	0	
Elbow Reef, Outer Point.....	26	33	0	76	51	0	
Harbour Island, East End.....	25	31	0	76	32	0	The Survey of Mr. Anthony De Mayne, of the British Navy, and the Observations of the Spanish officers employed in surveying the coasts of the Mexican Sea, &c.
Egg Island Reef, N.W. End.....	25	33	45	76	55	0	
NASSAU Lighthouse, New Providence [3]	25	5	0	77	19	0	
Anchorage at the Stirrup Kays ...	25	49	0	77	55	0	
Great Isaac, centre of [4].....	26	2	0	79	3	0	
Moselle Reef, Bemini Isles.....	25	50	0	79	15	0	
Riding Rocks.....	25	11	0	79	8	0	
Orange Kays, Middle of the	24	55	30	79	7	0	
Roquillos or Little Rocks	24	52	0	79	8	0	
Guincho or Ginger Kay.....	22	47	0	77	56	0	
Lobos or Seals' Kay.....	22	24	0	77	29	0	
Mucaras or Diamond Point.....	22	9	0	77	12	0	
Kay of St. Domingo	21	45	0	75	44	0	
Cayo Verde, or Ragged Island....	22	0	0	75	0	0	
Yuma, S.E. Point of.....	22	51	0	74	49	0	
Rum Kay, S.E. End of, [5].....	23	38	40	74	46	0	
Southampton Reef, N.E. End....	24	1	0	74	57	0	
Watling's Island, S.W. Point.....	23	59	0	74	31	0	
Atwood's Kay, West Point.....	23	10	0	73	47	0	
Bird Rock, Crooked Island.....	22	49	0	74	20	0	
Long Kay, South End of.....	22	28	0	74	18	0	
Castle Isle [6]	22	7	40	74	17	40	
Mirapovos, S.W. Kay	22	6	0	74	31	0	
Planas or Flat Kays, centre.....	22	43	0	73	32	0	
Mayaguana or Mogane, S.W. Point	22	23	0	73	11	0	
Eastern end of East Reef	22	17	0	72	39	0	
THE CAYCOS, [7]							
Northern end of the Reef	21	59	0	71	57	0	
Little Cayco, S.W. Point	21	37	0	72	25	0	
Southern Kays, West End.....	21	10	0	71	51	0	
S.E. Elbow of the Bank.....	21	1	0	71	32	0	
Cape Comet.....	21	45	0	71	26	0	
The Hogsties, West Point.....	21	41	0	73	52	0	
GREAT INAGUA, or Heneaga:							
N.W. Point.....	21	8	20	73	40	0	
S.W. Point.....	20	55	49	73	36	30	
S.E. Point	20	59	0	73	6	0	
LITTLE INAGUA, or Heneaga:							
East Point.....	21	28	30	72	55	30	
West Point.....	21	30	0	73	5	0	

THE BAHAMA AND PASSAGE ISLANDS CONTINUED.

	LAT. N.			LONG. W.			AUTHORITIES.
	°	'	"	°	'	"	
TURK'S ISLANDS:							
Sand Kay	21	11	0	71	8	42	The Spanish Surveyors, &c.
Salt Kay.....	21	20	0	71	7	0	
Grand Kay	21	26	42	71	5	0	
Square Handkerchief, S.W. Corner	20	53	0	70	55	40	
N.E. Corner	21	23	0	70	24	0	
Silver Kay, or Plate Bank:							
West End.....	20	30	0	69	59	0	
S.E. Point	20	13	50	69	28	0	
N.E. Point	20	31	0	69	26	0	

NOTES.

1. **MATERNILLO BANK and REEF.**—The Maternillo Bank, to the northward of the reef, is not represented in Mr. De Mayne's chart, although given in that of the Spanish Surveyors. The water over it is deep, but appears broken; the effect of reverberating currents; especially with the wind from the northward and eastward. See, farther, *Colombian Navigator*, Vol. I., page 175.

2. **HOLE IN THE ROCK.**—The latitude of this important point was inaccurately given in our fourth edition, from a literal error in the MS. from which we copied it. It certainly does not lie higher than $25^{\circ} 52'$: and, with more probability, as stated in the Table.

3. **NASSAU.**—The position appears to be finally settled. The Spanish surveyors gave the town as in $24^{\circ} 4' 33''$ N. and $77^{\circ} 19' 30''$ W. Mr. De Mayne as $25^{\circ} 5' 18''$ N. and $77^{\circ} 19'$ W.

4. **GREAT ISAAC.**—This islet is described in the *Colombian Navigator*, but it may not be amiss to notice that it is moderately high, has several wells of fresh water, and abundance of large shell-fish. The Providence droggers water here.

5. **RUM KAY.**—This island has been very erroneously represented on the charts, both as to magnitude and position. The white cliffs at the S.E. end are remarkable, and may be seen 6 leagues off. For a more particular description, see the '*New Sailing Directory for the Windward and Gulf Passages*,' published by Mr. Laurie, 1825, page 109.

6. **CASTLE ISLE.**—The point appears to be finally settled. Former observations gave $22^{\circ} 7' 45''$ N. and $74^{\circ} 17' 30''$ W. Mr. De Mayne gives $22^{\circ} 7' 37''$, and $74^{\circ} 17' 52''$.

7. **CAYCOS.**—Captain Livingston's Remarks on the Northern Reefs of the Caycos, and the danger of approaching them, without great caution, may be found in the '*Colombian Navigator*,' Vol. I. page 191. Captain Livingston says, "By observation of the sun's meridian altitude, in December, 1816, by a back observation, I made the latitude of the north part of the reef $21^{\circ} 59'$ N., which is the same, or nearly so, as represented on the charts. The N.W. point of the Caycos I made, by observations in October, 1817, and Jan. 1818, about $21^{\circ} 56'$. These observations having been made from the deck of a very low vessel, and the refraction being apparently greater than usual, and from my having no barometer on board, I dare not depend confidently on them; but I am perfectly satisfied that any vessel shaping a course from off the Booby Rocks, to weather the N.W. point of the Caycos, by any chart hitherto published, will infallibly find himself entangled among the reefs on the west side of the Watering Bay; as was, I have reason to suppose, the case with the United States sloop of war Chippewa, the English ship Aimwell, Captain Hawkins, and brig Messenger, Captain Knubley, the wrecks of all which I have seen on these reefs. When a vessel once gets embayed among them, it must be next to impossible to beat out; as the reefs extending out from the land to the eastward hook suddenly round, at their outer extremity, to the southward. Thus a vessel may be in blue and deep water while the hook of the reef is outside her. I have three times examined the appearance of these reefs from the mast heads of different vessels, and each time they appeared to me more dangerous than they had previously done." And. Livingston.

VARIATIONS OF THE COMPASS.—The present Variation at the Head of the Maternillo Bank is about 5° E. At Nassau, in Providence Island, Mr. De Mayne found it, in 1816, to be $5\frac{1}{2}^{\circ}$ E. In the same parallel, Captain Livingston found it, on the Great Bank, to the westward, to be nearly the same, in 1818. At Watling's Island, it is 5° E., and, near the South end of the Crooked Islands, $4^{\circ} 40'$ E.

15. CUBA, JAMAICA, &c.

	LATITUDE.			LONGITUDE.			AUTHORITIES.	
	°	'	"	°	'	"		
S.E. AND EAST OF CUBA.								
Cape de Cruz	19	47	16	77	40	30	The officers acting under the orders of the Spanish government, for the purpose of ascertaining, by chronometers, &c., the positions of all the principal points in the West-Indies.	
Peak of Tarquino	19	52	57	76	45	0		
St. IAGO de CUBA, Morro at the Entrance [1]	19	57	29	76	2	45		
Port Guantanamo, Entrance	19	54	5	75	14	30		
Port Escondido, E. Point	19	54	55	75	2	36		
Port Baitiqueri, Entrance	20	1	59	74	50	0		
CAPE MAYSI or MAIZE	20	13	30	74	1	0		
Port de Mata, Entrance	20	17	10	74	12	30		
Port de Baracoa, Entrance	20	20	50	74	21	0		
Port de Maravi, Entrance	20	24	11	74	24	45		
Port de Navas, Entrance	20	29	44	74	27	52	The results, generally, exhibit the longitude to the eastward of the situations formerly assigned; excepting that the Requisite Tables now state Havanna to be in 82° 8' 56", instead of 82° 15' 36". In the former edition it stood 82° 18' 30", which appears to have been nearer to the truth.	
Port de Cayaguaneque, E. Point	20	30	0	74	29	27		
Port de Taco, West Point	20	31	17	74	33	30		
Port de Jaragua, Entrance	20	32	44	74	36	30		
Punta (Point) de Guarico	20	39	0	74	41	0		
Port de Cayo Moa, Kay	20	42	18	74	49	0		
Port de Yaguaneque, Entrance	20	42	0	74	58	20		
Port de Cananova, Entrance	20	41	30	75	0	0		
Port de Cebollas, Entrance	20	41	52	75	3	0		
Port de Tanamo, Entrance	20	42	41	75	14	0		
Port de Cabonico, Entrance	20	42	11	75	23	40	The Surveying Officers acting under the orders of the Spanish Government, &c., with subsequent emendations, as shown in the Notes.	
Port de Nipe, Entrance	20	44	49	75	29	0		
Port de Banas, S.E. Point	20	52	50	75	36	0		
Punta (Point) de Mulas	21	7	30	75	35	0		
NORTHERN KAYS AND COAST OF CUBA.								
Cayo Verde, or Ragged Island ..	22	1	0	75	5	0		
Cayo de S. Domingo	21	45	0	74	44	0		
Cayo de Lobos, or Seal Kay	22	24	0	77	29	0		
Cayo de Guincho, or Ginger Kay ..	22	47	0	77	56	0		
Port de Sama, Entrance	21	5	50	75	48	0		
Port de Naranjo, Entrance	21	5	23	75	53	10		
Port de Vita, Entrance	21	6	0	75	57	40		
Port de Bariay, Entrance	21	4	9	76	1	0		
Port de Jururu, Entrance	21	3	39	76	2	30		
Port de Gibara, Entrance	21	6	12	76	7	0	REMARKS. We have here given the situation of all the harbours in Cuba, which have been surveyed by the Spanish officers. The latitudes are those engraved on the particular charts; but the longitudes have been subsequently rectified: those of the north coast are more to the eastward, and	
Port del Padre, Entrance	21	15	40	76	26	30		
Port Malagueta, Entrance	21	17	0	76	33	0		
Port de Manati, Entrance	21	23	44	76	44	0		
Port de Nuevas Grandes, Entrance ..	21	26	50	76	51	0		
Punta (Point) Maternillos [2] ..	21	39	0	76	59	30		
Cayo Romano, [3] S.E. Point	21	53	0	77	36	0		
Cayo Verde, or Green Kay	22	5	6	77	36	15		
Cayo Confites (<i>Sugar-Phum Kay</i>), North Point	22	11	44	77	37	0		

CUBA, JAMAICA, &c., CONTINUED.

	LATITUDE.			LONGITUDE.			AUTHORITIES.
	°	'	"	°	'	"	
Double-Headed Shot, [4] N.W.	23	57	0	80	21	0	Spanish Surveyors.
Kay	23	39	8	80	10	0	
Cayo de Sal, or Salt Kay	23	14	0	80	56	30	REMARKS, continued.
Cayo Cruz del Padre	23	2	54	81	31	58	
MATANZAS, Cast. de S. Severino ..	23	1	39	81	34	30	agree with the large general chart of the Bahama Old Channel, published by the Direccion Hidrografica of Madrid, and since in London.
Pan or Hill	23	9	26	82	15	36	
HAVANNA, Morro, Lighthouse [5]	23	5	58	82	39	31	The greater part of the Harbours are singularly formed, having a narrow entrance, mostly bordered with a reef or shoal, but opening into a basin inward, which affords shelter from every wind. Of such are, St. Iago, Guantanamo, Escondido, Baitiqueri, Mata, and Baracoa; but the entrance of the latter is bold-
Port del Mariel, Entrance	23	4	0	82	52	30	
Port de Cavanias, Entrance	22	58	49	83	6	40	to: again, Iaco, Yaguaneque, Cebollas, Tanamo, Cabonico and Livisa, Nipe, Banes, Naranjo, Vita, Jururu, Del Padre, Malagueta, Manati, Nuevitas, Havanna, Mariel, Bahia-Honda, and Jagua.
Bahia Honda, Entrance	22	48	0	83	22	0	
Guaijabon, Pan or Hill							
S.W. COAST OF CUBA.							
CAPE ANTONIO [6]	21	54	0	84	57	30	
Cape Corrientes [6]	21	48	0	84	29	20	
Cayo Blanco	21	50	0	83	12	0	
Isle of Pines, S. W. Point [6] ..	21	31	37	83	0	0	
Bahia de Jagua or Xagua	22	1	0	80	35	37	
Puerto Casilda, Entrance	21	36	0	79	59	0	
The GRAND CAYMAN,							
East end [7]	19	18	30	81	5	0	{ Lat. Capt. A. Livingston, 1817: Long. Captain Lake, R.N. and J. W. Monteath.
S.W. Kay or Point	19	15	0	81	29	0	
JAMAICA and ISLES ADJACENT. [8]							
Morant Kays, N.E. Kay	17	26	30	75	54	0	
S.W. Kay	17	23	45	75	56	0	
Morant, or E. Pt. of Jamaica [9]	17	58	0	76	4	0	
South-east or Folly Point	17	56	30	76	5	0	
Yallah's Point	17	52	0	72	28	0	
PORT ROYAL [10] Point	17	55	7	76	49	0	
Kingston, church	17	57	57	76	46	10	
Portland Point	17	42	30	77	7	30	
Pedro Bluff	17	50	30	77	49	0	
Black River, the Mouth of	18	1	10	77	56	0	
John's Point	18	11	30	78	22	0	
South Negril	18	15	45	78	31	0	
Montego Bay Point	18	32	30	78	1	30	
Galina Point	18	29	0	76	53	0	
N.E. End or Point [11]	18	12	0	76	14	30	
FORMIGAS, N.E. Part	18	34	30	75	38	0	
S.E. Part	18	28	30	75	40	0	
S.W. Part	18	28	0	75	48	0	
NAVAZA, centre of the Isle [12] ..	18	23	15	75	6	0	
SHOALS SOUTHWARD OF JAMAICA.							
Portland Rock [13]	17	9	0	77	25	0	
Baxo Nueva, or New Shoal, Sandy Kay [14]	15	52	20	78	37	58	
Serranilla, East Part [15]	15	45	20	79	48	20	The Spanish Surveyors, &c. (See the Notes.)

NOTES.

1. **ST. IAGO de CUBA.**—Mr. Nicholls, Master of the Sheerwater, brig of war, in 1819, communicated the situation of the Morro castle of St. Iago, from observations made in that ship, as follows. Lat. observed, $19^{\circ} 57' 50''$: Long. by lunars, $76^{\circ} 2' 45''$: by chronometer, $76^{\circ} 0'$.

Captain Livingston says of this: "On the preceding communication, by Mr. Nicholls, I remark that, knowing Mr. N. to have the reputation of an excellent observer, and having, also, heard from himself, that he had, at least, one very good assistant, I place confidence in his determination.

The Spanish chart of the harbour represents the Morro as in $75^{\circ} 55' 33''$ W.; but the charts, in general, have it to the westward of the situation assigned in the Table. In our former editions it was given as $76^{\circ} 4' 35''$ W.

2. **NUEVITAS.**—The channel into this Harbour is to the S. by E. 4 miles from Point Maternillos. It is five miles in length, and although not, in some places, more than two cables in breadth, it forms, by its crooked shape, a convenient place of shelter. The depths within are variable, but mostly from 12 to 5 fathoms: but there seems to be a shoal spot, of 17 feet, in the middle of the entrance.

3. **CAYO ROMANO, &c.**—In the year 1781, M. le Marquis de Chabert, when proceeding from St. Domingo to the Chesapeake, had an opportunity of observing, by chronometers, the longitude of Cayo Romano, Port Matanzas, and the Pan of Matanzas; and his results were, for the first, $77^{\circ} 39' 45''$ W., and, for the last, $81^{\circ} 36' 30''$, being, in the mean, only 3 minutes to the westward of the late determinations.

4. **DOUBLE-HEADED SHOT.**—The position is given according to the last edition of the Spanish Chart of the Mexican Sea, &c. 1811, edited by the late Admiral Don José de Espinosa, first Director of the Hydrographic Establishment at Madrid. In the first edition, published (by order of the Minister of the Marine, Don Juan de Langara,) in 1799, the N.W. Kay was represented in latitude $23^{\circ} 53'$, longitude $80^{\circ} 14'$. We have been obligingly informed, by Lieut. W. C. Harris, of the Royal Navy, that, from lunar observations made in H.M.S. Apollo, off this point, he believes the first edition to be correct. The mean of the two may, perhaps, be nearer to the truth. Mr. De Mayne places the N.W. Kay in $23^{\circ} 55'$ N. and $80^{\circ} 26'$ W.

This is not the only variation to be found in the different editions of the Spanish charts; even on points marked as determined; although the observations of the Spanish officers are generally admitted, by those who have given them a practical examination, to be excellent. It may not be superfluous here to notice that, the eastern extreme of Florida, in latitude $26^{\circ} 35'$, appeared in the first edition of these charts in $80^{\circ} 5\frac{1}{2}'$ W.; but, in the last edition, it is placed in $79^{\circ} 54\frac{1}{2}'$, or 11 minutes more to the eastward. We have followed the latter, not merely because the most recent, but because, where doubt exists, we have generally preferred that position which may be least dangerous to the navigator.

The coast being thus assumed, the Florida Kays and Reefs have been laid down from the Trigonometric Survey of Mr. George Gauld, made by order of the Lords of the Admiralty; whence it will be found that they extend 5 minutes more to the West than as represented on the Spanish Charts.

5. **HAVANNA and LIGHTHOUSE.**—The given position is from the observations of Don José del Rio, who surveyed the harbour in 1798. Mr. De Mayne has placed it 4 minutes more to the West.

The Lighthouse on the Morro Castle, upon the east point of the harbour, was first lighted in the month of June, 1818. The contractor for this light, Dr Pendergrast, lighted it with gas, but this was so unsteady, that it may probably be altered, and changed from an irregular stationary to a regular revolving light.

6. CAPE ANTONIO, ISLE OF PINES, &c.—On the 12th of August, 1817, Captain Livingston came to an anchor off Cape Antonio, in 7 fathoms; and, by an excellent observation, found his latitude to be $21^{\circ} 53' 54''$; this confirms that which has been given by the Spanish officers: but he had previously ascertained that Cape Corrientes, Punta Piedras, Cayo Blanco, and the Isle of Pines, were placed too much to the southward, in the charts, in consequence of their not having been regularly surveyed. For a detail of the particulars, see the *Colombian Navigator*, Vol. I. pages 215, 216.

The longitude of Cape Corrientes, &c. has been rectified by Captain J. W. Monteath, as shown in a note on the pages above mentioned.

In all the Jardines, eastward of the Isle of Pines, excellent fresh water may be found, by digging a few inches deep in the sand, at a very short distance from the sea. On the Indian Kays, the Kays of San Felipe, &c. West of the Isle of Pines, no water is to be found.

7. GRAND CAYMAN.—The latitude of the S.W. Kay of the Grand Cayman, as observed by Captain Livingston, 5th August, 1817, appeared to be $19^{\circ} 14'$, not $19^{\circ} 11'$, the parallel formerly assigned: the longitude was communicated to us by the late Captain Hurd, as a determination to be relied on, and it has been very happily confirmed by Captain J. W. Monteath, as shown in the *Colombian Navigator*, Vol. I. page 286.

8. JAMAICA, in general.—The Admiralty chart, by Mr. De Mayne, 1823, represents Jamaica very differently from that of Mr. Leard, which we had previously adopted. By the former, the East end of the island appears 8 minutes more to the West than in Mr. Leard's, and the West end 6 minutes less: thus reducing the length by 14 minutes, equal to 13 miles. The difference is greater in Mr. Robertson's map of Jamaica, 1804, which agrees exactly with Mr. Leard as to the position of Port Royal; but in it the east end of the island is $3' 48''$ more, and the western-most end $14'$ less, to the West; making, therefore, the island appear $17' 48''$ of longitude ($16\frac{1}{2}$ miles) shorter than it had before appeared. We know not how to reconcile these differences; and, therefore submit the different statements, for the sake of comparison and investigation. The following is from Mr. De Mayne.

South Coast.—Morant Point, $17^{\circ} 55\frac{1}{2}'$ N., $76^{\circ} 12'$ W.: Port Morant, Entrance of, $17^{\circ} 52'$ N., $76^{\circ} 22'$ W.: Yallah's Point, $17^{\circ} 52'$ N., $76^{\circ} 41'$ W.: Port Royal Dock Yard, $17^{\circ} 53' 18''$ N., $76^{\circ} 52\frac{1}{2}'$ W.: Portland Point, $17^{\circ} 43'$ N., $77^{\circ} 11'$ W.: Portland Rock, $17^{\circ} 7\frac{1}{2}'$ N., $77^{\circ} 29'$ W.: Pedro Bluff, $17^{\circ} 52\frac{1}{2}'$ N., $77^{\circ} 45\frac{1}{2}'$ W.: South Negril, $18^{\circ} 15'$ N., $78^{\circ} 25'$ W.

North Coast.—North Negril, $18^{\circ} 22\frac{1}{2}'$ N., $78^{\circ} 24'$ W.: Pedro Point, $18^{\circ} 28'$ N., $78^{\circ} 17\frac{1}{2}'$ W.: Montego Bay Point, $18^{\circ} 30'$ N., $77^{\circ} 57'$ W.: Galina Point, $18^{\circ} 24'$ N., $76^{\circ} 55'$ W.: N.E. End, $18^{\circ} 9'$ N., $76^{\circ} 20\frac{1}{2}'$ W.

The Formigas, according to Mr. Francis Owen, N.E. part, $18^{\circ} 35'$ N., $75^{\circ} 50'$ W.: S.W. part, $18^{\circ} 27'$ N., $76^{\circ} 0'$ W.

Mr. Leard places North Negril in $18^{\circ} 23'$ N. and $78^{\circ} 29'$ W. Captain J. W. Monteath, from twelve observations, 9th Dec. 1820, deduced the longitude by chronometer, as $78^{\circ} 35'$; by lunars, $78^{\circ} 29' 50''$; mean of both, $78^{\circ} 32' 25''$. Captain Wilson, as stated in the Nautical Almanac, had previously made it $78^{\circ} 32'$. The Salisbury's chronometers, in 1817, on the contrary, gave the western points of the island in from 5 to 7 minutes less than the longitudes assigned by Mr. Leard's Survey.

9. EAST POINT, OR POINT MORANT.—The Requisite Tables give the same latitude, with longitude $76^{\circ} 15' 45''$. The latter must be incorrect. The Spanish Chart of the Antillas places the point in $76^{\circ} 10'$ W.: but see the next Note.

10. PORT-ROYAL AND KINGSTON.—Some remarks by Mr. Gauld state the longitude of Port-Royal as $77^{\circ} 3'$; although, from observations made by Messrs. Chandler and Macfarlane, in 1753, it appeared to be only $76^{\circ} 42' 30''$ (*Phil Trans*); the Requisite Tables state it at $76^{\circ} 44' 45''$, and the Spanish charts have it $76^{\circ} 54'$. Mr. Leard gives it as $17^{\circ} 58'$ N. and $76^{\circ} 47'$ W.

Our late worthy and respected friend, Mr. Francis Owen, Master-attendant at Jamaica, from repeated observations of the sun for the latitude, with a circle and sextant, by the true and artificial horizon, and several sets of lunar distances, taken by himself and Mr. Duncan Murphy, Master of H.M.S. Polyphemus, in the years 1808, '9, 10, and 11, gave the position of Port-Royal Point as in the Table, $17^{\circ} 55' 7''$ N. and $76^{\circ} 49' 0''$ W.

Captain Livingston, with an excellent sextant, in February, 1817, concluded his situation, at about 300 yards W.N.W. from the S.E. bastion of Fort Charles, to be $17^{\circ} 55' 35''$ N. This gentleman received a statement of the latitude of the S.E. angle of Fort Charles, as observed by the Spanish astronomers, from Don Rafael Tono, at Cartagena, which made it $17^{\circ} 55' 33''$; and to his communication adds, "I am, on the whole, however, disposed to consider the latitude as found by Mr. Owen as most correct, both from the excellence of his instruments, his well-known abilities as an observer, the immense number of observations taken by him and others, which gave $17^{\circ} 55' 7''$ as a mean result in 1811, and which result has been confirmed since, by a series of observations, taken at Mr. Owen's observatory, by many very intelligent officers of his Majesty's navy."

The latitude of Kingston Church was given by the Spanish astronomers, in June, 1805, from observations taken with an astronomical quadrant of 2 feet radius, by stars north and south of them: the mean of their observations give the latitude of the church as $17^{\circ} 57' 57''$. The church bears from Port-Royal Point N. 48° E. true, $3\frac{1}{4}$ miles; this, therefore, gives the longitude of the church.

11. NORTH-EAST END.—The latitude of the N.E. end of Jamaica, from observations taken by Captain Livingston, on two days in March, 1817, appeared to be only $18^{\circ} 10' 30''$. This is noticed as worthy of future examination.

12. NAVAZA.—The latitude in the Table, from Captain Livingston's observations, in October, 1817, settles a previous statement, which made it $18^{\circ} 23' 0''$. Mr. Owen assigns to Navaza the meridian of $75^{\circ} 9\frac{1}{2}'$. His description of this isle is given in *The New Directory for the Windward and Gulf Passages*, 1825, page 38.

13. PORTLAND ROCK.—The Portland Rock is a single Kay, with small bushes on it, which lies about 12 leagues S. by W. $\frac{1}{2}$ W. by compass from Portland Point. It has been variously represented in from lat $17^{\circ} 7\frac{1}{2}'$ to $17^{\circ} 13'$, and from long. $76^{\circ} 32'$ to $77^{\circ} 31'$. In Mr. De Mayne's chart, it appears in $17^{\circ} 7\frac{1}{2}'$ N., and $77^{\circ} 29'$ W. The position given in our table cannot, we think, be far from the truth. See the *New Directory for the Windward and Gulf Passages*, 1825, page 50.

14. BAXO NUEVA.—According to the Spanish officers, the extent of this shoal is about 7 miles from North to South, and 14 miles from East to West. All the eastern part is a reef, very steep-to; but, on the west, the depth diminishes gradually. At a mile and a half from the northern extremity, is the Sandy Kay, given in the Table. The BAXO del COMBOY, which is represented on the charts to the E.S.E. of the new shoal, has been particularly searched for, but could not be found.

15. SERRANILLA.—This shoal is described by the Spanish surveyors, who have ascertained its situation. It extends 15 miles from East to West.

VARIATIONS OF THE COMPASS.—At the west end of Cuba, and about the Isle of Pines, the present variation is about 9° E. Near the east end, from 5 to 6 degrees. At the Grand Cayman, 8° E. At Port-Royal, Jamaica, Mr. Leard, in 1791, gave it as $6^{\circ} 50'$ E.; but, there is reason to believe that, for a long time past, it has not exceeded $6\frac{1}{2}$ degrees. In 1821, Mr. De Mayne gave it as $4^{\circ} 50'$ only.

**16. ST. DOMINGO, or HAYTI and HISPANIOLA;
with PORTO-RICO and the VIRGIN ISLANDS.**

	LATITUDE.			LONGITUDE.			AUTHORITIES.
	°	'	"	°	'	"	
Isle of Mona, the middle [1]	18	6	0	67	49	0	The Officers acting under the orders of the Spanish Government, for the purpose of ascertaining the positions of the principal points in the West-Indies, &c.
Isle of Saona, S.E. Point ...	18	12	0	68	31	30	
Isle of Santa Catalina, West Point	18	19	0	69	1	0	
City of St. Domingo.....	18	28	40	69	53	0	
Punta de Salinas.....	18	12	40	70	37	30	
Alto-vela, or Little Mount [2]	17	28	11	71	22	0	The results, generally, exhibit the longitudes to the eastward of the situations formerly assigned, although many observations had been previously made by scientific observers. The latitudes found by M. Puysegur, in his surveys of the northern coasts, made by order of Louis XVI., in 1784 and 1785, have been mostly verified; but the longitudes are from 4 to 6 minutes more to the East.
Aquin Bay, the Diamond Rock	18	13	48	73	20	0	
St. Louis, the Old Fort.....	18	14	27	73	31	30	
Les Cayes, the Town	18	11	10	73	44	0	
Isle a Vache, East Point ...	18	4	0	73	31	0	
Point à Gravois	18	1	3	73	55	0	Some previous observations had also been made by Messrs. Fleureau, Verdun, Borda, and Pingré, in their most useful voyages, made for determining various points of the Atlantic, already mentioned in some preceding notes; but the whole has been rectified in the course of the later operations.
CAPE TIBURON	18	19	25	74	27	32	
Point des Irois	18	22	23	74	29	40	
Isle of Navaza, middle.....	18	23	15	74	58	0	
Cape Dame Marie, or Donna Maria	18	37	25	74	25	0	
Point Jeremie	18	39	57	74	6	0	The Surveying Officers acting under the orders of the Spanish Government, &c.
Hummock of Petit Goave ..	18	26	51	72	50	30	
Isle of Gonave, N.E. Point	18	48	35	72	49	47	
PORT AU PRINCE.....	18	33	42	72	22	20	
St. Marc or St. Mark's Point	19	2	18	72	50	0	
Port à Piment	19	35	0	72	57	18	
St. Nicolas Mole Point	19	49	20	73	27	0	
Port à l'Ecu.....	19	55	8	73	5	0	
Port Paix, (Carenage Point)	19	56	0	72	43	0	
Tortue or Tortuda Isle, West Point	20	5	20	72	54	56	
East Point	20	3	33	72	34	10	
CITY OF CAPE HAYTIEN....	19	46	20	72	14	0	
The Grange Point.....	19	54	35	71	43	10	
Point Isabelica.....	19	58	43	71	12	0	
Old Cape François.....	19	40	30	69	56	30	
Cape Cabron.....	19	22	0	69	12	50	
Cape Samana	19	15	40	69	6	15	
Cape Enganno	18	34	30	68	20	30	
Point Espada.....	18	19	48	68	30	0	
ISLAND OF PORTO-RICO.							
Cape St. Juan, or N.E. Point	18	24	20	65	39	0	
MORRO CASTLE of ST. JUAN [3]	18	29	0	66	6	27	
Point Bruquen, or N.W. Pt.	18	31	18	67	7	0	
Isle Desecho or Zacheo	18	23	48	67	27	30	
Aguadilla, Town [4].....	18	25	10	67	7	17	
Point Algarroba	18	14	0	67	7	30	
Puerto Guanica, East Point	17	57	44	66	52	45	
Caja de Muertos, or Coffin, S.W. Point	17	50	30	66	35	0	

ST. DOMINGO, &c. CONTINUED.

	LAT. N.			LONG. W.			AUTHORITIES.
	°	'	"	°	'	"	
THE VIRGIN ISLANDS.							
Anegada, S.E. Point	18	43	48	64	16	30	The observations of the Spanish Officers, as already explained; particularly those of Captains Don Cosme de Churruca and F. Fidalgo, &c.
Virgin-Gorda, East Point ..	18	31	7	64	21	30	
St. John's, the S.E. Point ..	18	19	0	64	44	20	
St. Thomas's, Harbour, Fort Christian [5]	18	21	16	64	57	15	
St. CROIX OF SANTA CRUZ, Christianstæd [6]	17	44	8	64	43	30	

NOTES.

1. MONA.—A particular description and view of this island are given in the *Colombian Navigator*, Vol. I. pages 237, 8. Fresh water may be obtained here.

2. ALTO-VELA, or LITTLE MOUNT.—This is a high rocky islet, which serves as a general point of departure to all ships bound from the eastward to Jamaica, &c. It is peaked, and appears to the northward, at a distance, like a dome, emerging above a mist or fog. See, farther, the Book of Directions above mentioned.

3. MORRO OF ST. JUAN.—The Harbour of St. Juan was surveyed by Don Cosme de Churruca, in 1794, who has stated the position given in the Table. It has heretofore been represented more to the westward; and the Requisite Tables give the N.E. Point in $18^{\circ} 29'$, and $65^{\circ} 51'$, which is certainly erroneous. Zacheo is stated, in the same work, under the name of *Zachu Rocks*, as in longitude $67^{\circ} 45' 30''$, or 18 minutes to the westward of the longitude now assigned.

4. AGUADILLA.—The situation of Aguadilla, as given by the Spanish officers is $18^{\circ} 25' 53''$ N., and $67^{\circ} 6' 20''$ W. Captain Mackellar, R.N. gives it as $18^{\circ} 24' 57''$ N., and $67^{\circ} 8' 15''$ W. In this, as in some other instances, the mean of the two is the position given in the table.

5. ST. THOMAS'S.—With the position of Fort Christian, as given in the table, from a Danish survey, compare the communication of Capt. J. W. Monteath, *Colombian Navigator*, Vol. II. Note 2, page xv.

6. CHRISTIANSTÆD.—Observations by M. P. Lövenorn, a distinguished officer (now admiral) of the Danish marine, in 1782 and 1783, gave the latitude of this port as $17^{\circ} 45' 26''$, longitude $64^{\circ} 40' 26''$; and the East Point of Virgin-Gorda as in $18^{\circ} 31' 7''$ and $64^{\circ} 25' 39''$. The *Connaissance des Temps* gives the longitude of Christianstæd as $64^{\circ} 48' 14''$, which has been substituted for an intermediate statement of $64^{\circ} 40' 11''$. The same work gives the East Point of Virgin-Gorda according to M. Lövenorn's observations.

Mr. Andr. Lang, of the island of St. Croix, has a small observatory about a mile to the eastward of Christianstæd, and he states that the entrance of the harbour lies in $17^{\circ} 45' 30''$ N., and $64^{\circ} 45' 30''$ W. This, it may be seen, is two minutes to the westward of the longitude given in the table. The elevation of the observatory is 450 feet above the level of the sea. Mr. Lang says that the eastern extremity of St. Croix terminates in a bluff point, in lat. $17^{\circ} 45' 35''$, and long. $64^{\circ} 38'$. To the centre of the islet called *Buck or Goat Isle*, he assigns $17^{\circ} 47' 24''$ N., and $64^{\circ} 41'$ W. The remotest breakers of a shoal, which Mr. Lang discovered in 1824, may be seen from his observatory, and lie according to his observations, in $17^{\circ} 49' 37''$ N., and $64^{\circ} 28'$ W. The least water found on the shoal was over a steep coral ledge, whereon the depth is $5\frac{1}{2}$ fathoms, with Buck Isle bearing W.S.W. $\frac{1}{2}$ W. by compass, distant nearly nine miles; and the east end of St. Croix S.W. $\frac{1}{4}$ W. about 8 miles, and the shoal thence extended easterly as far as the eye could discern from the deck. The ledge above mentioned is narrow, and may, at times, be passed unnoticed, without great attention to the lead, it being without that strong reflection by which a sandy bottom is distinguished.

VARIATION OF THE COMPASS.—From the S.W. end of St. Domingo, where the variation is 5° E. it diminishes to the eastward; and it has lately been found, in the Mona Passage, and about the Virgin Islands, to be from $3\frac{1}{2}$ to 3 degrees East. At St. Croix 2° E.

17. The CARIBBEE and LEEWARD ISLANDS.

	LAT. N.			LONG. W.			AUTHORITIES.																																																																
CARIBBEE ISLANDS. [1]	°	'	"	°	'	"																																																																	
Sombrero [2]	18	38	0	63	29	30	The observations of the Spanish Officers, &c. as already explained.																																																																
Anguilla, West Point	18	11	0	63	16	20																																																																	
St. Martin's, West Point ...	18	4	0	63	14	0																																																																	
Saba, the middle	17	39	20	63	19	0																																																																	
St. Bartholomew, East Point	17	54	0	62	52	0																																																																	
St. Eustatius, the Road [3]	17	29	30	63	4	30	The new Chart of the Islands and Channels of St. Bartholomew, St. Martin, Anguilla, Dog and Prickly Pear, &c., by Mr. S. Fahlberg, lately published by Mr. Laurie, exhibits different points, as follow : <table><tr><td>Dog Island (Middle)</td><td>18</td><td>18</td><td>25</td><td>N.</td><td>63</td><td>27</td><td>30</td><td>W.</td></tr><tr><td>Great Anguilla Kay</td><td>18</td><td>8</td><td>0</td><td>—</td><td>63</td><td>11</td><td>45</td><td>—</td></tr><tr><td>Anguilla, East Point</td><td>18</td><td>17</td><td>35</td><td>—</td><td>62</td><td>56</td><td>45</td><td>—</td></tr><tr><td>St. Martin's, West Point ..</td><td>18</td><td>2</td><td>50</td><td>—</td><td>63</td><td>9</td><td>50</td><td>—</td></tr><tr><td>Hat I. (N.E. of St. Martin)</td><td>18</td><td>5</td><td>30</td><td>—</td><td>63</td><td>1</td><td>0</td><td>—</td></tr><tr><td>St. Bartholomew (N.E. Pt.)</td><td>17</td><td>52</td><td>40</td><td>—</td><td>62</td><td>53</td><td>35</td><td>—</td></tr><tr><td>Gustavia</td><td>17</td><td>51</td><td>0</td><td>—</td><td>62</td><td>57</td><td>40</td><td>—</td></tr></table> It is clear that these islands are very incorrectly delineated in the Spanish Chart.		Dog Island (Middle)	18	18	25	N.	63	27	30	W.	Great Anguilla Kay	18	8	0	—	63	11	45	—	Anguilla, East Point	18	17	35	—	62	56	45	—	St. Martin's, West Point ..	18	2	50	—	63	9	50	—	Hat I. (N.E. of St. Martin)	18	5	30	—	63	1	0	—	St. Bartholomew (N.E. Pt.)	17	52	40	—	62	53	35	—	Gustavia	17	51	0	—	62	57	40	—
Dog Island (Middle)	18	18	25	N.	63	27			30	W.																																																													
Great Anguilla Kay	18	8	0	—	63	11			45	—																																																													
Anguilla, East Point	18	17	35	—	62	56			45	—																																																													
St. Martin's, West Point ..	18	2	50	—	63	9			50	—																																																													
Hat I. (N.E. of St. Martin)	18	5	30	—	63	1			0	—																																																													
St. Bartholomew (N.E. Pt.)	17	52	40	—	62	53			35	—																																																													
Gustavia	17	51	0	—	62	57			40	—																																																													
St. Christopher's Basse-Terre [4]	17	19	30	62	49	30																																																																	
Nevis, Charlestown [5]	17	10	0	62	44	0																																																																	
Redonda	16	55	30	63	26	0																																																																	
Montserrat, N.E. Point	16	48	0	62	16	20																																																																	
Antigua, St. John's Road [6]	17	9	40	61	57	0																																																																	
Desirade or Deseada, N.E. Point [7] ..	16	20	0	61	6	30																																																																	
Guadeloupe, Basse-Terre [8]	15	59	30	61	47	30																																																																	
Marie-galante, Basse-Terre	15	52	0	61	22	0																																																																	
The Saintes, Western, S.W. Point	15	51	20	61	44	0																																																																	
Dominica, Road of Roseau [9]	15	18	30	61	28	0																																																																	
Martinique, Fort Royal [10]	14	35	55	61	7	30																																																																	
St. Lucia, Pt. Moulacique or South Point	13	35	0	61	1	0																																																																	
St. Vincent, Kingston	13	9	0	61	15	0																																																																	
Barbadoes, Bridgetown [11]	13	5	30	59	43	40																																																																	
Granada, Fort St. George [12]	12	2	54	61	49	40																																																																	
Tobago, N.E. Point	11	20	13	60	33	30																																																																	
S.W. End [13]	11	7	35	60	52	30																																																																	
TRINIDAD [14]							The admirable Survey of the Coasts of Venezuela, &c., by Don Joaquin Francisco Fidalgo, and other Spanish officers. Published, by the ' <i>Direccion Hidrografica</i>, ' at Madrid, in 1816 and 1817.																																																																
Pt. de Galera, or N.E. Point	10	50	20	60	56	35																																																																	
Pt. de la Galeota, or S.W. Point	10	9	30	61	0	50																																																																	
Boca de Navios, or Ship Channel	10	41	45	61	48	0																																																																	
Port Spain	10	38	42	61	34	15																																																																	
Testigos, centre	11	23	15	63	10	50																																																																	
MARGARITA																																																																							
Pampatar	10	59	15	63	53	30																																																																	
North Point	11	10	30	63	58	30																																																																	
Pta. de Arenas, or Sandy Point	10	59	0	64	29	30																																																																	
Blanquilla, North Pt.	11	54	30	64	41	50																																																																	
Tortuga, East Point	10	54	45	65	16	50																																																																	
Orchilla, N.E. Breakers	11	52	45	66	9	30																																																																	
Shoal of Two Fathoms	12	9	15	66	9	20																																																																	
Los Roques or Roccas, N.E. Islet	11	58	40	66	42	20																																																																	
Islas de Aves, (Birds' Is.)																																																																							
Windward Isle	11	57	30	67	31	20																																																																	
Leeward Isle	11	59	30	67	45	35																																																																	
Buen-ayre, N.E. Point	12	14	0	68	18	30																																																																	
CURAZAO, North Point	12	24	0	69	16	20																																																																	
Bay of St. Anne, Entr.	12	6	20	69	3	0																																																																	
Little Curazao, North End ..	12	0	0	68	44	30																																																																	
Oruba, the S.E. Point	12	23	45	70	0	0																																																																	

NOTES.

1. **WINDWARD and LEEWARD ISLANDS.**—Under the denomination of Windward Islands, the navigators of France and Spain include the whole range from the Virgins to Trinidad; and, under that of Leeward Islands, the range which exists between Trinidad and the Gulf of Maracaybo. This distinction is natural and proper, and we have adopted it, in preference to the former distinction in the English charts, which includes, under the name of Leeward Islands, those from Porto-Rico to Dominica only; and, under that of Windward Islands, those from Martinique to Tobago.

The observations of the Spanish officers for determining the respective situations of the Caribbee Islands, have been very numerous and important, and our late charts have been regulated chiefly thereby. Some later corrections have, however, been made, particularly in the northern part of the range, and in the Virgin Isles. *Anegada*, in particular, is laid down in the Spanish Chart too much to the south. See "*Colombian Navigator*," Vol. II. pages 9 and 10.

2. **SOMBRERO.**—This solitary islet is a flat and rocky eminence, $2\frac{1}{2}$ miles in length, N.N.E. and S.S.W., without any hummock, having neither quadruped or vegetable upon it, excepting grass, and that generally dry, with a few weeds, &c. It is even destitute of water. See "*Colombian Navigator*," Vol. II. page 15.

3. **EUSTATIUS.**—The latitude of the road, according to observations made at sea, in the frigate *La Flore*, by Messrs. Verdun, &c., is $17^{\circ} 29'$, and the longitude $63^{\circ} 2'$. The position given in the table has been corroborated by Captain Monteath: "1820, 15th Nov. in latitude $17^{\circ} 23'$; longitude of the East point of Eustatius, by chronometer, $63^{\circ} 2' 15''$; by lunar observations, $63^{\circ} 7' 8''$; mean, $63^{\circ} 4' 41''$."

4. **St. CHRISTOPHER'S.**—In January, 1782, the Marquis de Chabert took nine meridian altitudes, whence he concluded the latitude as in the Table. The longitude, by his marine clocks, previously examined at Martinique, appeared as $62^{\circ} 52' 30''$.

5. **NEVIS.**—The latitude, from the observations of Captain Monteath, appeared to be as follows: "1820, Nov. 15. In 17 fathoms of water upon the bank on the south side of Nevia, Charlestown bearing North, distant about three miles, I observed the latitude to be $17^{\circ} 3' 30''$; adding $3'$ on the bearing of Charlestown, gives $17^{\circ} 6' 30''$: the existing tables gave $17^{\circ} 10' 30''$: but this, I am confident, is too far to the north."

6. **ANTIGUA.**—East point of Green Isle. 1820, 14th Nov. as seen from latitude $16^{\circ} 55'$. Three observations by Captain Monteath: the chronometer gave $61^{\circ} 39' 23''$: lunars, $61^{\circ} 44' 16''$: mean, $61^{\circ} 41' 50''$."

7. **DESIRADE.**—From observations made by the Chev. de Borda, he computed the latitude of the N.E. Point as $16^{\circ} 20' 30''$.

Captain Monteath, in latitude $16^{\circ} 58'$, by three observations. Longitude of ship by chronometer, $61^{\circ} 9' 45''$; by lunars, $61^{\circ} 14' 38''$; mean, $61^{\circ} 12' 12''$. Bearing of Desirade, S. 5° E. distance 36 miles, which gives $3'$ of departure, = $\times$ longitude $3' 5''$. Hence, longitude of the centre of Desirade, $61^{\circ} 9' 7''$.

8. **GUADALOUPE.**—The latitude of Basse-terre has been confirmed from the observations of M. de Verdun, &c. The longitude (assuming Fort Royal, Martinique, as in $61^{\circ} 9'$) appeared to be $61^{\circ} 48' 15''$. M. Tondou, in 1783, concluded the longitude, by three immersions and two emersions of the first satellite of Jupiter, to be $61^{\circ} 48'$. The latitude of Pointe des Chateaux, the eastern point, was observed by M. de Borda, as $16^{\circ} 12' 30''$.

9. **ROSEAU.**—The latitude of this place, according to the result of observations by Messrs. Verdun, &c., is $15^{\circ} 18' 23''$. But the French officers have given the longitude $7\frac{1}{2}$ minutes to the westward of that shown in the Table, which cannot be correct.

10. **MARTINIQUE.**—The latitude accords with that resulting from the observations of Messrs. Verdun, Borda, &c., who concluded the longitude as $61^{\circ} 9'$, or only one minute and a half more than that now given in the Table.

11. **BARBADOES.**—The late Dr. Nevil Maskelyne communicated the latitude of St. Michael's Church, in Bridge-town, as $13^{\circ} 5' 30''$. The longitude at present stands, in the Requisite Tables, $59^{\circ} 41' 15''$.

12. **GRANADA.**—In 1779, M. de Chabert concluded the latitude of Fort St. George as $12^{\circ} 2' 54''$, and its longitude $42\frac{1}{2}$ minutes West of Fort Royal, Martinique. This varies only 20 seconds from the statement in the Table.

13. **TOBAGO.**—M. de Chabert, 1781, made the longitude of the *S.W. Point* $20'$ to the East of Fort Royal, Martinique: this places the point in only $60^{\circ} 47\frac{1}{2}'$ W. The position formerly given in the *Connaissance des Temps*, was $11^{\circ} 6' N.$ and $60^{\circ} 49' W.$ The Baron Alex. de Humboldt, in his '*Personal Narrative*,' (Eng. Transl.) gives it as $10^{\circ} 20' 13'' N.$ and $60^{\circ} 27' 30'' W.$ The latter is evidently a great error, as it would place Tobago directly East of the body of Trinidad. We presume that the N.E. end was intended: and that in $11^{\circ} 20' 13'' N.$, not $11^{\circ} 10' 13''$, as now in the *Conn. des Temps*. But if, upon conjecture, we take M. Humboldt's longitude thus, we shall place Tobago too far to the east: for it is allowed that the situation of Trinidad has been settled by the Spanish surveyors, and it is well known that the high land of Trinidad is seen from the ships at anchor in Courland Bay, over the land of Sandy Point, which could not be the case if the former authorities were correct. See the New Chart of the Coasts, &c., from Tobago to Barcelona, lately published by Mr. Laurie.

14. **GENERAL NOTE.**—The positions of the West-India Islands as given in the *Requisite Tables*, are so incorrect, in general, unless in the cases wherein the preceding observations occur, that we have not deemed them worthy of farther notice.

VARIATION OF THE COMPASS.—In the channel between Porto-Rico and the Virgin Islands, the variation is about 4 degrees East: but, on the east of Anegada, it diminishes to 2° East. At Antigua and Guadaloupe it is 3° East; and nearly the same thence to Granada. At Barbadoes, only $2\frac{1}{2}^{\circ}$; but on the N.E. side of Trinidad, 4 degrees.

18. THE COASTS OF GUYANA, COLOMBIA, &c., to the GULF of MEXICO, inclusive.

	LAT. N.			LONG. W.			AUTHORITIES.
	°	'	"	°	'	"	
CAPE NORTH [1]	1	51	0	—	—	—	M. de la Condamine and the French Engineers.
St. Luis of Oyapok, Fort ...	3	57	0	—	—	—	
CAYENNE [2]	4	56	15	52	16	30	
Brams Point, Surinam [3] ..	5	56	0	55	15	0	The late Capt. Thos. Goodall, &c. Deduced from Brams Point.
PARAMARIBO	5	49	0	55	13	30	
Corobana Point, Demerary [4]	6	48	0	58	1	35	Capt. E. Thompson, R.N., &c.
Boca de Guayma	8	25	0	59	52	0	{ Latitude, ' <i>Derrotero de las Antil- las</i> :' Longitude inferred by chart.
RIVER ORINOCO: [5]							
Punta or Point Barima ...	8	44	0	60	3	0	Don Cosmé de Churruca and the Baron Alex. de Humboldt.
Isle Cangrejos, N.E. Point	8	51	0	—	—	—	
TRINIDAD. See the preced- ing Section, page 48							
Cape Three Points [6]	10	45	15	62	45	50	The Spanish Surveys of the Coasts of Venezuela, &c., mentioned on page 48.
Cape Malapascua	10	42	50	63	6	35	
CUMANA, the City of [7] ...	10	27	37	64	15	15	
Puerto de Mochima, Entr. ..	10	24	30	64	26	0	The whole of the Colombian coast, from the Island of Trinidad to Chagre, has been so finely and accurately sur- veyed, by Don Joaquin Fidalgo, and other Spanish officers, as to leave no- thing more to wish for, so far as the survey extends: the South side of the Gulf of Venezuela only excepted.
Isla Boracha, N.E. Point ...	10	19	30	64	49	20	
BARCELONA, Morro of	10	13	15	64	48	20	
Piritu Isles, Centre	10	9	0	65	1	35	
Isle Unare, Centre	10	5	15	65	21	0	
Cape Codera [8]	10	35	54	66	11	30	
Chuspa, the Point	10	39	30	66	25	35	
Guayra, the Road	10	37	0	67	1	35	

THE COASTS OF COLOMBIA, &c., CONTINUED.

	LAT. N.			LONG. W.			AUTHORITIES.
	°	'	"	°	'	"	
CITY of CARACAS (<i>St. Iago de Leon</i>)	10	30	0	67	0	55	The Spanish Surveys of the Coasts of Venezuela, &c., mentioned on page 48.
Puerto de Turiamo	10	29	10	67	57	20	
PUERTO CABELLO, Entrance	10	29	45	68	7	35	
Punta Tucacas, Kay off	10	50	0	68	20	5	
Punta de S. Juan	11	9	0	68	31	35	
Punta del Ubero	11	19	30	68	49	15	
Punta del Manzanillo	11	31	15	69	24	5	
Vela de Coro	11	26	30	69	42	5	
CAPE S. ROMAN	12	11	0	70	8	35	
Punta de la Macolla	12	5	0	70	21	20	
Santa Anna de Coro	11	24	0	69	49	50	
Punta de Espada	12	4	0	71	11	50	
Bahia Honda Entrance	12	20	0	71	50	35	
CAPE LA VELA	12	11	0	72	15	35	
Rio de la Hacha, Town	11	33	30	72	58	55	
Cape S. Augustin	11	16	0	73	40	5	
Cape S. Juan de Guia	11	20	45	74	4	20	
Cape de la Aguja	11	18	50	74	16	20	
SANTA MARTA	11	15	0	74	17	35	
Rio Magdalena							
Boca de Rio Viejo	11	5	0	74	47	35	
Boca de Ceniza	11	5	20	74	56	20	
Punta de la Galera	10	47	0	75	29	5	
Punta de Canoas	10	34	15	75	35	50	
CARTAGENA, Popa [9]	10	26	0	75	37	5	
Salmedina Bank (2 fms.)	10	23	0	75	44	35	
Islas del Rosario, larger I. ..	10	11	0	75	49	35	
Islas de S. Bernardo, Tintipan or North I.	9	48	0	75	55	20	
Santiago de Tolú	9	30	45	75	39	50	
Puerto de Cispata, Entrance ..	9	25	0	75	51	55	
Isla Fuerte	9	23	30	76	15	5	
Punta Arenas, Entrance of G. of Darien	8	33	0	77	0	5	
Cape Tiburon	8	41	15	77	26	35	
Puerto Carreto	8	47	15	77	38	35	
Isla de Pinos, N. Point of ..	9	1	30	77	50	30	
Cayo Ratones	9	23	0	78	20	5	
Punta S. Blas, E. Point	9	34	36	79	2	5	
Punta del Manzanillo	9	39	30	79	36	50	
PUERTO VELO, or Porto Bello, the Town	9	24	29	79	43	40	
Punta del Toro	9	23	45	80	1	20	
Chagres	9	21	0	80	4	5	
Roncador, North end of the Reef [10]	13	35	7	80	3	3	The Spanish Surveyors, 1804. For Serranilla, &c., see page 42.
Serrana [10] North side	14	28	46	—	—	—	
South side	14	18	7	—	—	—	
East side	—	—	—	80	2	3	
West side	—	—	—	80	21	54	
Serranilla, East side	15	45	20	79	48	20	Spanish Chart, 1810. Spanish Observers, with emendation.
CAPE GRACIAS A DIOS [11] ..	14	54	0	82	45	0	
Cape Camaron	16	2	0	85	8	0	
Truxillo	15	54	0	85	57	0	

THE COASTS OF COLOMBIA, HONDURAS, &c.

	LAT. N.			LONG. W.			AUTHORITIES.
	°	'	"	°	'	"	
Swan Islands, South end....	17	22	0	83	36	0	Capt. John Burnett, of Port-Glasgow.
Albion Bank, E.N.E. end [12]	18	55	0	83	9	0	
W.S.W. end...	18	53	0	83	16	0	Capt. Geo. Randall, 1816.
Guanaja or Bonacca, East Point of,.....	16	30	0	85	47	0	Captains W. J. Capes, of London, and J. Burnett, of Port-Glasgow, a Survey of Mr. Duvernay, &c.
Ruatan, S.W. Point [13]...	16	18	0	86	47	30	
Half-moon Kay, on the Eastern Reef, <i>Lighthouse</i> [14]	17	12	30	87	25	30	
Kay Bokel.....	17	7	0	87	56	0	
Glover's Reef, N.E. end....	16	53	30	87	35	0	
BALIZE, the Road of,.....	17	36	0	88	32	0	
Cosumel, North end.....	20	36	0	86	50	0	
Punta Brava	21	0	0	86	44	0	
CAPE CATOCHE.....	21	34	0	86	57	30	
Monte Notepederas.....	21	10	0	90	2	30	
CAMPECHE, TOWN [15]	19	51	0	90	28	15	The Spanish Surveys of the Mexican Sea, 1808—1814, with several emendations by Capt. John Mackellar, of the British Navy, &c. and Additions by the Baron Alex. de Humboldt.
Javinal Point.....	19	12	30	90	52	30	
Punta de Xicalango	18	41	0	91	50	0	
Barra de S. Pedro.....	18	40	0	92	25	0	
Barra de Tabasco	18	34	30	92	35	0	
Barra de Chiltepeque.....	18	26	30	92	59	0	
Rio Tupilco, Entrance of...	18	26	0	93	21	0	
Barra de Goazacoalcos.....	18	10	0	94	17	0	
La Barilla	18	10	0	94	30	0	
Punta de S. Juan.....	18	18	0	94	33	0	
Roca Partida, or <i>Cleft Rock</i> ...	18	43	0	95	2	0	
BARRA de ALVARADO [16]..	18	45	0	95	42	0	
VERA CRUZ [17].....	19	12	0	96	8	38	
Xalapa.....	19	30	8	96	55	0	
Cofre de Perote [18]	19	32	54	97	8	0	
Peak of Orizaba or Orizava [18].....	19	2	17	97	12	15	
Puebla de los Angeles	19	0	15	98	2	45	
Toluca	19	16	19	99	21	45	
Tescuco	19	30	40	98	51	15	
MEXICO [19].....	19	25	45	99	5	30	
Cape Roxo.....	21	36	0	97	18	0	
BARRA de TAMPICO.....	22	15	56	97	50	18	
Barra de Santander.....	23	46	0	98	2	0	
Boquillas Cerradas	25	0	0	97	45	0	
Rio Brava del Norte.....	25	55	0	97	24	0	
Bar of St. Bernardo.....	29	0	0	96	50	0	
Galveston Bay, Extr. of Bar	29	10	0	96	1	0	

NOTES.

1. CAPE NORTH TO CAPE ORANGE.—For a description of the Coast, &c., see the '*Colombian Navigator*,' Vol. II. page 72.

2. CAYENNE.—The situation of this town was given by M. la Condamine, in 1774, from four eclipses of the first satellite of Jupiter, as in the Table.

3. BRAMS POINT.—In order more readily to distinguish this point, a beacon, 70 feet high, was erected upon it in the year 1817. This beacon, which stands about a mile to windward of the point, exhibits a broad tin vane, painted white. When the vane is

first distinguishable from any vessel advancing from the eastward, she may be considered as on the edge of the mud-bank. The body or frame of the beacon is boarded around, and painted white.

4. DEMERARY.—The position given in the Table accords with that given in the Spanish Book of Directions, entitled '*Derrotero de las Antillas*,' of which a complete and corrected translation, from the pen of Captain Livingston, is now incorporated in the two volumes of the '*Colombian Navigator*.'

As the whole of the coast of Guyana is described in the second volume of the same work, we shall add only, that it is, in general, very low, and soundings reach out to a great distance. Those soundings are the chief guidance in making the coast, which cannot be seen at the distance of five leagues: a nearer approach than two leagues is dangerous; the water being shoal, with extensive banks of sand and mud. The harbours are the mouths of rivers only, and each is obstructed by a bar of the same quality. Hence practical knowledge is necessary to all who attempt to enter.

If it be required to beat to windward on this coast, or to proceed from the Orinoco, Essequibo, or Surinam, to Cayenne, it is necessary to work along the coast with the ebb-tide, in from $3\frac{1}{2}$ or 4 fathoms of water, outward to 8 or 9 fathoms: for, though you may be shouldered away by the current to the N.E., you will gain very well on the tack to the S.E. or E.S.E.: but, with the flood-tide, you must anchor; for, then, both wind and current being against you, you would inevitably be driven ashore.

Those who, from the Antillas, are bound to any port in Guyana, should keep their larboard tacks on board, until in a convenient latitude to make the land to the southward of the port of destination: this may be more or less to the southward, according to the navigator's experience on the coast. The most experienced have frequently been deceived, and observations for latitude, with every other precaution, should, therefore, be taken.

5. RIVER ORINOCO.—For the positions given by M. de Humboldt, &c. see the English translation of his '*Personal Narrative*,' Vol. V, pages 719, 20. Here it may be noticed that no regular survey of the mouth of this river has yet been made, and we have even some reason for believing that the given longitude is to be considered only as an approximation. It should further be understood, that the points Barima and Sabaneta have been confounded with each other. The Punta Barima, or Cape Bremé, of the English and Dutch charts, is the Sabaneta Point of the Spanish: and the Sabaneta Point of our charts is the Punta Barima of theirs. For the points of the interior, see the '*Colombian Navigator*,' Vol. II., Table, page ix.

6. CAPE THREE POINTS, &c.—From the Bocas del Drago or Great Dragon's Mouth to Cape Three Points, the land is high and hilly, and the coast remarkably clean; so that a ship may run along it, at the distance of half a mile. At a mile from the shore, the depths are from 20 to 40 fathoms, muddy sand.

7. CUMANÁ.—The castle of S. Antonio, on which the national flag of Colombia is occasionally hoisted, is only 30 toises ($31\frac{1}{2}$ fathoms) above the level of the sea. Placed on a naked and calcareous hill, it, however, commands the town, and forms a very picturesque object to vessels entering the port.

8. CAPE CODERA and PORTS of VENEZUELA.—The principal establishments for commerce on this coast, and towards which vessels from Europe, in general, direct their course, are Cumana, Barcelona, La Guayra, and Porto Cabello; Maracaybo, Santa Marta, and Cartagena; Pampatar, in the island Margarita, and St. Anna in Curazao. It is a general rule on the coast to make the land to windward of the port of destination, in order to prevent falling too far to leeward. Having once entered the Caribbean Sea, it will be proper to make the land about Cape Three Points, or Cape Malapasqua, if bound to Cumana or Barcelona; and those bound to La Guayra will make Cape Codera, &c.

9. CARTAGENA.—The POPA of Cartagena is a remarkable hill, having a monastery on its summit, (Nra. Sra. de la Popa,) which stands at rather more than a mile to the eastward of Cartagena. Of this celebrated town, most of the houses are three stories in height, many of two stories, and a considerable number of only one. The city is commanded completely by the castle of S. Felipe or S. Lazaro, situated on an eminence to the eastward; and this is, in turn, commanded by La Popa. At a short distance to the westward of the monastery is a signal-staff, with a battery, mounting about four guns. When the city bears east, nearly the whole of it is visible from sea. In advancing from the eastward, be extremely cautious on rounding the point of Zamba, as that point is low and dangerous.

10. RONCADOR, SERRANA, and ISLE of PROVIDENCE.—We have given the positions of Roncador, Serrana, and Serranilla, from the '*Derrotero de las Antillas*.' The Spanish chart of the sea of the Antillas, 1805, represents Roncador in $79^{\circ} 45' W.$ or 18 minutes more to the eastward, and the eastern side of Serrana in $79^{\circ} 42'$, or 20 minutes more to the east.

On the contrary, from observations made in 1819, in the Sheerwater, sloop of war, by Mr. Nicholls, the master, it appears that the kay on the west end of Roncador reef, which is about 6 feet above water, lies in $13^{\circ} 33' N.$ and $80^{\circ} 7' W.$; and the south end of Roncador Reef in $13^{\circ} 28\frac{1}{2}' N.$ and $80^{\circ} 4^{\circ} W.$

We have already had occasion to notice, with respect, the name of Mr. Nicholls, (see Note 1, page 43,) and should have little reason to question his results, did the last not vary so considerably as it does from the Spanish documents. There were two chronometers on board the Sheerwater, but it is said that neither of them could be depended on.

11. CAPE GRACIAS A DIOS.—Don Josef del Rio, who visited the Bay of Gracias a Dios, in 1793, has said that, from circumstances which he has explained, the depth of this bay is gradually diminishing, and it is possible that, in a few years, it may be filled up, so much as to prevent vessels from taking the shelter, which has heretofore been so useful, during the *Norths*, or North-winds.

12. ALBION BANK.—This bank was discovered by the ship Albion, of New York, commanded by Geo. Randall, 8th November, 1816. It is two leagues in extent, from W.S.W. to E.N.E. The least water found over it was 10 fathoms, but the bottom is very plainly to be seen. For particulars, see the '*Colombian Navigator*,' Vol. I. page 287.

13. RUATAN and BAY of HONDURAS.—For many years past we have heard the repetition of a general complaint as to the errors of the charts of Honduras, &c., and, upon investigation, have found them but too well founded. The Swan Islands, Bonacca, Ruatan, were all inaccurately represented, both in latitude and longitude: but the more serious dangers existed in Glover's Reef, the Eastern Reef and Kays, Kay Bokel, &c. all of which were exhibited in from 12 to 16 miles of latitude to the southward of their true situation, and variously as to longitude. The Spanish charts of this part, having been copied from the English, retain these errors. Our friend Captain Cape says, in consequence of them many ships have been lost, by mistaking one point or kay for another. The current is also to be particularly attended to.

See, farther, the New Chart of the Bay of Honduras, &c. published by Mr. Laurie.

14.—HALF-MOON KAY.—The new light-house on this kay has been already noticed in the '*Colombian Navigator*,' Vol. II. page 170. Its light is elevated about 50 feet above the surface of the sea, and the lighthouse is extremely useful to strangers bound to Balize, as well by day as by night; for it very frequently happens that they get considerably to the southward of the fairway, owing to the indraught to the south westward, &c.

15. CAMPECHE.—The position is from the Journal of Captain Mackeller, which corroborates that of the Spanish officers.

16. ALVARADO, &c.—During the late arduous but glorious contest for the independence of Mexico, the harbour of Alvarado became one of the chief places of trade in the Mexican Sea. It is a bar-harbour, with about 12 feet on the bar, which generally has a heavy breaking sea on it, and, of course, is very dangerous. See farther, on this subject, the Addenda to the '*New Sailing Directory for the Windward and Gulf Passages*,' 1825, page 166.

The Roads of Anton Lizardo are situated at 7 leagues N.W. by N. (*true*), from Alvarado, and 5 leagues to the S.E. of Vera-Cruz. They afford the safest anchorage to be found hereabout. The best spot is about a mile and a quarter north-eastward from the Point of Anton Lizardo, between it and the largest reef. A particular plan of this anchorage has been re-published by Mr. Laurie.

A low reef, lately discovered, and about two miles in length, lies N.E. by E. $\frac{1}{2}$ E. (*true*) 31 miles from Vera-Cruz, and N.N.E. $\frac{1}{2}$ E., 24 miles from Point Lizardo.

17. VERA CRUZ.—There is now a most excellent revolving light on the N.W. corner of the castle of S. Juan de Ulna. The machinery was made in London, and there is a spare set, lest any accident should befall that now in use. The centre of the lantern is elevated 79 feet above the level of the sea; the light is from 21 lamps, having reflectors, 7 on each side of a triangle, which make the revolution as follows: From the first appearance

pearance of light, it appears bright for about six seconds; then a faint glimmering for forty seconds, and so on alternately. This light may be seen 12 miles off in clear weather.

In consequence of hostilities the light was discontinued in 1824; there can, however, be little doubt of its re-establishment, in the season of peace and tranquillity.

18. **PEAK OF ORIZABA and COFRE de PEROTE.**—The situations of these celebrated mountains are indicated in the Charts. The first, which is always covered with snow, is stated, by the Spanish surveyors, to be 6517 varas (2981 English fathoms) in height, above the level of the sea, and its highest point may be seen, above the horizon, at the distance of 50 leagues. Its true bearing and distance from Vera-Cruz are W. 9° S. 61 miles. This mountain, of a conic form, became Volcanic in 1545, and continued for twenty years, since which time there has been no appearance of inflammation. Though the summit be clothed with perpetual snow, the sides are adorned with beautiful forests of cedars, pines, and other trees.

The *Cofre de Perote* is stated to be 5097 varas (2332 English fathoms) high, above the level of the sea. Its distance from the nearest part of the coast is about 13 leagues.

19. **MEXICO.**—In the old maps, charts, and tables, this city is placed a degree too far to the westward: the sea-coast was also placed nearly as much too far to the west. The difference is shown by the valuable map of the Mexican provinces, constructed by M. de Humboldt. The Requisite Tables at present give the longitude of Mexico as $99^{\circ} 41' 45''$, and that of Vera Cruz as $95^{\circ} 3' 0''$; thus making a difference of more than $4\frac{1}{2}$ degrees between the two; although the true difference does not exceed three degrees.

VARIATION OF THE COMPASS.—From the Island Trinidad, where the easterly variation is about 4° , that variation is found to increase to the westward. By observations made in and subsequent to 1816, it has been found to exist as follow: At Cape Vela, and thence to Chagre, from 6 to $6\frac{1}{2}^{\circ}$ E.; in the Bay of Honduras, 8° E.; at Vera Cruz, about 9° E.; and at Tampico, $8\frac{1}{2}^{\circ}$ East.

SECTION II.

GENERAL OBSERVATIONS on the WINDS, TIDES, and CURRENTS, and on the DIFFERENT PASSAGES, over the ATLANTIC OCEAN.

1. OF THE WINDS AND TORNADOES.

WINDS IN GENERAL.—As the earth, by its diurnal rotation on its axis, presents, in succession, every part of its circumference to the sun, the heat of that luminary, by rarefying the air, is found to be the chief cause of winds. For, as the air is a fluid, subjected to the same laws of gravitation as other fluids, it has a constant tendency to preserve an equilibrium in every part: so that if, by any mean, it be rendered lighter in any one place than another, the weightier air will rush in from every side, until as much be accumulated as makes it of an equal weight with the rest of the atmosphere. These currents of air are called WINDS.

The Winds are divided into PERENNIAL, PERIODICAL, and VARIABLE. They are also divided into General and Particular. PERENNIAL, or Constant, Winds are those which always blow the same way; such is that easterly wind, between the tropics, commonly called the TRADE-WIND. PERIODICAL WINDS are those which constantly return at certain times: such are land and sea-breezes, blowing alternately from land to sea, and from sea to land. VARIABLE, or Erratic, Winds are such as blow now this way, now that, and are now up, now hushed, without regularity either as to time or place: such are the winds prevalent in England, &c.

WINDS are generally found to vary according to the situation of land. For the temperature of the land, according to the degree to which it is heated by the sun, al-

ways affects the disposition and strength of the wind. Thus, it is found, that, the heated land of Africa, by rarefying the atmosphere, produces a breeze from the sea; and from this circumstance it arises, that lands, which would otherwise be parched up or burnt, are rendered habitable. It is observed, generally, that the continental coasts, between the tropics, are almost always blown upon *obliquely*, from seaward, by winds whose course is affected by the winds which prevail in the extensive seas that surround them.

PERENNIAL or TRADE-WIND.—But, over extensive tracts of ocean, *remote from land*, and in the lower latitudes, or toward the equator, Perennial or Trade-Winds are found to prevail, which follow the course of the sun: thus, on the Atlantic Ocean, at about 100 leagues from the African shore, between the latitudes of 10 and 26 degrees, a constant breeze prevails from the north-eastward. Upon approaching the American side, this N.E. wind becomes more easterly, or seldom blows more than one point of the compass from the East, either to the northward or southward. This appears to be caused by the heated lands to the westward rarefying the air, and causing an indraught that way, as a contrary wind is induced on the African Coast.

The **PERENNIAL or TRADE-WIND**, on the American side of the Atlantic, extends, at times, to 30 degrees of latitude, which is about 4 degrees farther to the northward than on the African side. Likewise, on the south of the equator, the Perennial Wind, which is here from the south-east, extends 3 or 4 degrees farther towards the Coast of Brasil than on the opposite side of the ocean.

The general cause of this wind is the motion of the earth, in its diurnal rotation, which thus presents, in succession, every part of its circumference to the sun; and the atmosphere becoming successively heated, a constant stream is thus produced. This is sufficient to show, that, in the regions near the equinoctial line, a constant rarefaction is produced by the sun, and a current of air consequently follows that luminary in his progress from East to West.

HEAT increases evaporation, and renders the atmosphere capable of supporting a greater quantity of moisture than it would do in a cooler state: this is a powerful agent in the causes which produce a diversity of winds and weather, especially to the northward and southward of the tropics; for, by this addition of moisture, the air is more fully expanded, and becomes specifically lighter, than it would be in the same degree of heat in a drier state.

Were the atmosphere of one continued warmth, and its motion uniform, there would be no rain; for it would not imbibe more moisture in exhalation than it could support; therefore, in a perennial wind, notwithstanding the great evaporation, there is seldom any rain; but, from accidental causes, these winds are alternately stronger and weaker, with frequent clouds, and sometimes light showers.

These circumstances are assumed as prevailing at a considerable distance from the land, and from the limits of the perennial wind; for, every where near the land, when the sun has great influence, it occasions land and sea-breezes near the shores; and, in particular situations, heavy gusts and squalls of wind. The Trade-Winds are more steady and uniform in the Pacific Ocean, from its greater extent, and also in the Ethiopic, than in the Atlantic Ocean, where Cape Verde and the broad part of Africa extend so much to the westward, and the northern part of Brasil, in America, to the East.

Small islands, lying at a great distance from the main land, operate very little upon the Trade-Wind. If elevated, these islands are more subject to rain than if low: this may be occasioned, principally, by the ascent given to the wind, or atmosphere, in rising over the tops of the hills; when, being cooled, it condenses into small drizzly rain. This is an effect peculiar to all mountains, even in the middle of continents, when the atmosphere is sufficiently charged with moisture. For the sun's rays, by heating the atmosphere, according to its density, renders it much warmer at the bottom than at the top of hills. Upon a mountain, sloping from the sea towards the top, and about 700 yards in height, a pleasant breeze has been observed inshore, and fine clear weather; the air in ascending, (being condensed by cold,) at about half-way up, had the appearance of fog, or thin light flying clouds: but at the top was a misling rain; and this may frequently be seen in any mountainous country.*

The clouds, in the higher regions of the air, are frequently seen to move in a direction contrary to the wind below. The reason of this variation is, that the cool dense air below forces the warm and rarefied air upwards, where it spreads so as to preserve the equilibrium; and hence the upper course, or current, appears in a contrary direction. Thus circulating, the N.E. Trade-wind has frequently a S.W. wind above it; and a S.E. wind often prevails beneath one whose direction is N.W. It is consequently found, that, just without the limits of the Trade-wind, the wind generally blows from the opposite quarter. The counter-current of air, above, is often seen in a fresh Trade-wind; for the great power of the sun between the tropics so rarefies the atmosphere under his meridian, that it has not so much influence in the upper region, where the atmosphere is light: hence the motion of the upper part takes its direction contrary to the Trade-wind.*

The space from latitude 25° to 28° or 29° , between the Variable and Trade-winds, is remarkable for a continual change of winds, with sudden gusts and calms, rain, thunder, and lightning. This space has been called the *Horse Latitudes*, because it has often been found necessary here to throw overboard the horses which were to be transported to the West-Indies, &c. To the northward of these latitudes, upon the American Coast, and more than one-third over the Atlantic, westerly winds prevail nearly nine months in the year.

In the latitudes above the Trade-winds, the wind from the W.S.W. ward being replete with moisture, from the great exhalation between the tropics, as it approaches the cold and higher latitudes, becomes condensed into showers of hail, rain, or snow. For instance, in the 50th degree of North latitude, the wind from the S.W. generally will prevail till the atmosphere is more condensed than in the lower latitudes; the wind from the colder regions then ensues, and blows till the equilibrium of the atmosphere is restored, when a short calm generally succeeds before the wind shifts into another quarter.

There is often an interval of calm between the Trade-winds and the opposite winds in high latitudes. This is not, however, always the case; for, if the Trade-wind in its borders be much to the eastward, it frequently changes gradually round without an interval of calm. There is generally, also, a calm in a certain space between two prevailing winds blowing in opposite directions, as between the Trade-wind and the westerly wind on the African Coast. In the limits of the Trade-wind, a dead calm is generally the prelude to a storm, and it ought always to be considered as a prognostic thereof; for it is known that the conflux of the Trade-wind and the variable winds is the cause of calms and storms in the tropical regions.

When the sun is at its greatest declination, North of the equator, the S.E. wind, particularly between Brasil and Africa, varying towards the course of the sun, changes a quarter or half a point more to the southward, and the N.E. Trade-wind veers more to the eastward. The contrary happens when the sun is near the southern tropic; for then the S.E. wind, South of the line, gets more to the East, and the N.E. wind, on the Atlantic, veers more to the North. In June, July, August, and September, while the sun is returning from the northern tropic to the equator, the action of its rays upon the land and sea, in the northern part of the globe, renders the wind less constant by altering the state of the atmosphere.

* *The Causes of Tornadoes, Hurricanes, and Squalls*, have been thus assigned by Dr. HARE, of Philadelphia:—The air, being a perfectly elastic fluid, its density is dependent on pressure, as well as on heat, and it does not follow that air, which may be heated in consequence of its proximity to the earth, will give place to colder air from above. The pressure of the atmosphere varying with the elevation, one stratum of air may be as much rarer by the diminution of pressure consequent to its altitude, as denser by the cold consequent to its remoteness from the earth, and another may be as much denser by the increased pressure arising from its proximity to the earth, as rarer by being warmer. Hence, when unequally heated, different strata of the atmosphere do not always disturb each other. Yet, after a time, the rarefaction in the lower stratum, by greater heat, may so far exceed that in the upper stratum, attendant on an inferior degree of pressure, that this stratum may preponderate and begin to descend. Whenever such a movement commences, it must proceed with increasing velocity; for the pressure on the upper stratum, and, of course its density and weight, increases as it falls; whilst, on the contrary, the density and weight of the lower must lessen it as it rises, and hence the change is, at times, so much accelerated as to occasion the furious and suddenly varying currents of air which attend tornadoes, hurricanes, and squalls.

On the African side, the winds are nearest to the South, and on the American side, nearest to the East. In these seas Dr. Halley observed, that, when the wind was eastward, the weather was gloomy, dark, and rainy, with hard gales of wind; but, when the wind veered to the southward, the weather generally became serene, with gentle breezes, next to a calm.

The EQUATORIAL LIMITS of the N.E. Perennial or Trade-wind between the meridians of 18 and 26 degrees West, have been found, upon the comparison of nearly 400 journals, English and French, to vary considerably, even in the same months of the year. We have shown, on the Chart, where the N.E. Trade, according to the probable mean, may be expected to cease in the different months: but the annexed Table will be found to answer the purpose more precisely.

In this Table the columns of *Extremes* show the uncertain termination of the Trade-winds, as experienced in different ships. The annexed columns show the *Probable Mean*: and the last column exhibits the mean breadth of the interval between the N.E. and S.E. winds.

Thus, the Table shows, that, in the month of January, the N.E. trade has been found sometimes to cease in the parallel of 10° , and sometimes in that of 3° N. That the probable mean of its limit is about 5° N.—That the S.E. trade, at the same time, has been found to cease sometimes at only half a degree North of the line, and sometimes at 4 degrees. That the probable mean of its limit is, therefore, two degrees and a quarter. And, that the interval between the assumed means of the N.E. and S.E. Trade-winds is equal to $2\frac{1}{4}$ degrees: and so of the rest.

TABLE showing the EQUINOCTIAL LIMITS of the N.E. and S.E. TRADE-WINDS, between the MERIDIANS of 18 and 26 DEGREES WEST.

N.E. TRADE-WIND.			S.E. TRADE-WIND.		INTERVAL BETWEEN.
CEASES,	General Extremes.	Probable Mean.	General Extremes.	Probable Mean.	Mean Breadth.
In January at $\cdot 3^{\circ}$ to 10° N.		5° N.	$0\frac{1}{2}^{\circ}$ to 4° N.	$2\frac{3}{4}^{\circ}$ N.	$2\frac{1}{4}$ degrees.
February $\cdot \cdot \cdot 2$ to 10 —		4 —	$0\frac{1}{2}$ to 3 —	$1\frac{1}{4}$ —	$3\frac{1}{4}$
March $\cdot \cdot \cdot \cdot 2$ to 8 —		$4\frac{3}{4}$ —	$0\frac{1}{2}$ to $2\frac{1}{2}$ —	$1\frac{1}{4}$ —	$3\frac{1}{2}$
April $\cdot \cdot \cdot \cdot \cdot 2\frac{1}{2}$ to 9 —		5 —	0 to $2\frac{1}{2}$ —	$1\frac{1}{4}$ —	$3\frac{3}{4}$
May $\cdot \cdot \cdot \cdot \cdot \cdot 4$ to 10 —		$6\frac{1}{2}$ —	0 to 4 —	$2\frac{1}{2}$ —	4
June $\cdot \cdot \cdot \cdot \cdot \cdot \cdot 6\frac{1}{2}$ to 13 —		$8\frac{1}{2}$ —	0 to 5 —	3 —	$5\frac{1}{2}$
July $\cdot \cdot \cdot \cdot \cdot \cdot \cdot \cdot 8\frac{1}{2}$ to 14 —		11 —	1 to 6 —	$3\frac{1}{2}$ —	$7\frac{1}{2}$
August $\cdot \cdot \cdot \cdot 11$ to 15 —		13 —	1 to 5 —	$3\frac{1}{4}$ —	$9\frac{1}{4}$
September $\cdot \cdot 9$ to 14 —		$11\frac{1}{2}$ —	1 to 5 —	3 —	$8\frac{1}{2}$
October $\cdot \cdot \cdot \cdot 7\frac{1}{2}$ to 14 —		10 —	1 to 5 —	3 —	7
November $\cdot \cdot 6$ to 11 —		8 —	1 to 5 —	3 —	$4\frac{1}{4}$
December $\cdot \cdot 3$ to 7 —		$5\frac{1}{2}$ —	1 to $4\frac{1}{2}$ —	$3\frac{1}{4}$ —	$2\frac{1}{4}$

In the space of variable winds between the trades, exhibited in the last column, it has been found, that southerly winds prevail more than any other; more particularly when the sun has great northern declination. Homeward-bound East-India ships are therefore enabled, at this season, to cross the space more quickly than those outward-bound; which they do, in some degree, at all other times. Yet calms and variable winds are experienced in every month of the year, within this space; but the former, which are more generally in the vicinity of the N.E. trade, seldom continue long. These calms are frequently succeeded by sudden squalls; against which every precaution should be taken; as many ships have lost their topmasts, and have been otherwise damaged by them. Whirlwinds have sometimes accompanied these squalls in their first effort against the resisting atmosphere.

It has been stated as probable, that a gale of wind, or storm, never happens here-about far from land, or near the equator in the open ocean, on any part of the globe; although, in its vicinity, sudden gusts of wind and whirlwinds are sometimes experienced. S.W. and W.S.W. winds, with much rain, are frequent in July, August, and sometimes in June and September.

The heated land of Africa within Cape Verde, with the Cape Verde Islands, produce in the vicinity the variable winds, and occasional calms, which counteract the trade-wind to a considerable distance from the coast. Hence it happens, that ships, which approach too near the coast or islands, lose the trade-wind sooner than those which keep at a greater distance. To guard against this, it has been recommended to commanders, to keep well to the westward when the N.E. trade fails; but some, in observing this precept, have crossed the line too far to the west; for, meeting with the S.E. trade, hanging far from the southward, with strong westerly currents, they have made the coast of Brasil, and been obliged, in consequence, to tack to the eastward.

It has been stated, and generally understood, that, at the eastern end of the interval, between the N.E. and S.E. trade-winds, there is a continual succession of calms, terrible thunder, lightning, water-spouts, and such frequent rains, that this portion of the ocean has been denominated *THE RAINS*. Ships have here, it is said, been detained for months, in passing between the latitudes of 10 and 4 degrees. The cause appearing to be, that the westerly winds, setting for the coast, and the easterly winds, here balance each other, and produce the calms; while the vapours, meeting and condensing, produce the almost ceaseless rains.

The words of *M. la Pérouse*, on his crossing the line, after passing Cape Verde, &c., are, in this place, worthy of particular notice. He says, "Nothing particular occurred during our passage to the line. The trade-wind left us in 14° North, and the wind then constantly blew between W. and W.S.W. till we reached the line, and obliged me to run down the coast of Africa, which I did at the distance of 60 leagues.

"We crossed the line on the 29th September, 1785, in 18° West longitude (15° 40' W. of Greenwich). I could have wished, as my instructions were, to have passed it more to the westward; but, fortunately, the wind drove us always to the eastward, otherwise it would have been impossible to have made Trinidad,* the wind being S.E. at the line, and continuing so until we reached latitude 20° 25' S.

"The dread, which some navigators entertain, of being, at this season, becalmed under the line, is founded on error. We were not a day without wind, and once only had rain; when, indeed, it was so abundant as to fill twenty-five casks.

"The fear of being driven too much to the eastward into the Gulf of Guinea is equally chimerical. The S.E. wind is soon met with, and even drives ships too rapidly to the westward; so that, had I been better acquainted with this navigation, I should have steered away more large with the S.W. wind, which constantly prevailed to the north of the line; and I should then have crossed it in the longitude of 10 degrees (7° 40' W. of Greenwich). This would have permitted me to run, with a free wind, on the parallel of Trinidad. A few days after our departure from Tenerife, we left the serene skies of the temperate zones; instead of which, a dull whiteness, between fog and cloud, always prevailed. The horizon was contracted; but, after sun-set, the vapour was dissipated, and the nights were constantly fine."

REMARKS on the WINDS and CURRENTS to the NORTHWARD and SOUTHWARD of the EQUATOR, in the Month of March, 1818, by Capt. J. W. MONTEATH.

On leaving St. Antonio, (Cape Verde Islands,) I shaped our course so as to cross the Equator on the meridian of 19° West. From that island the trade-wind continued steady from East to N.E. until in the sixth parallel of latitude: from this to the fourth parallel, the wind continued light from N.E. to North; and, to the second parallel, variable and squally, with heavy showers of rain. The current, between the third and second parallel, set S.E. by E. at the rate of 13 miles in twenty-four hours; and in 1° 30' N. set E.S.E. 10' in twenty-four hours. Gained the S.E. trade in latitude 1° 30' N., the wind from the S.S.E. to S.E.; between the parallels of 4° to 15° South experienced a westerly current of 80 miles in five days.

* The little Isle of Trinidad, lying in 20° 31' S. and 29° 10' W.

I perfectly agree with M. Perouse, that the dread which some navigators entertain of being becalmed in these parallels and 19° West is erroneous.

We were only about forty-eight hours without wind, from the parallel of 4° North to the time of gaining the S.E. trade; during which time we had abundance of rain; so much so that we filled all our empty casks.

On my return voyage, in January, 1819, I crossed the equator on the meridian of $20^{\circ} 30'$ West; we carried the S.E. trade until in the latitude of $4^{\circ} 30'$ North, at which parallel, in longitude $22^{\circ} 30'$ West, I found the current setting North by West at the rate of one mile and a half per hour.

This will point out the disadvantage of crossing the equator on this meridian, as a vessel would be set to the northward, as fast as the light winds would carry her southward.

PERIODICAL WINDS, &c.—Among the Canary Islands, northerly or N.E. winds mostly prevail; yet, being in the vicinity of the continent, westerly and southerly have been found to prevail there, sometimes for eight days successively.

During the months of November, December, January, February, and March, the winds from the East and N.E. are prevalent, in the country, between Cape Blanco and the entrance of the River Gambia. In this time the nights are cool; but scarcely has the sun arisen above the horizon, when the air becomes dry and parching. Nevertheless, these five months are the winter in this part of Africa, and this is the most healthy season. Between the Gambia and Cape Palmas, the inland winds, during the same season, are variable.

In June, July, August, September, and October, the country situated between Cape Verga and Cape Mount is much exposed to hurricanes, or tornadoes. These, however, do not occur in any part of the coast northward of Cape Verga.

From the 20^{th} degree of north latitude to the environs of the line, the months of July, August, September, and October, are those of the rainy season, when the atmosphere emits its waters to the earth; the only difference is, twenty days sooner or later in the arrival of these torrents. During the other eight months in the year there does not fall a single drop of water.

On the AFRICAN COAST, from Cape Blanco to Sierra Leon, the winds, at sea, excepting storms or land-breezes, have been stated to blow mostly rather from N. to N.W. than from the north to the eastward.

Between the CAPE VERDE ISLANDS, and in their neighbourhood, southerly and S.W. winds generally blow in July, August, September, and October. These islands, when the sun is in their zenith, are generally surrounded by thick fogs.

From SIERRA LEON to CAPE PALMAS, the ordinary course of the winds on the coast is from W.N.W., and beyond Cape Palmas, from W.S.W. to S.W. and S.S.W.

Although, in the Gulf of Guinea, the winds blow generally from the southward, and S.S.W. towards the coast, they take, in south latitude, a more westerly direction near the land, and often prevail from S.W. and W.S.W. between Cape Lopez and Benguela. But they veer proportionally more southerly as the distance increases from the coast.

WINDWARD COAST, &c.—The name of *Windward Coast* has been given by our navigators to the whole of that coast which extends from Cape Mount to the River Assinee, where the Gold Coast commences: it includes the three particular coasts called, 1st, Grain or Pepper Coast; 2d, Ivory or Teeth Coast; 3d, the Coast of Adou, or Quaqua.

From January until May, the weather here, along shore, is commonly fair and clear, with cooling breezes, and gentle southerly winds. But, about the middle of May, South and S.E. winds begin, accompanied not only with hurricanes and stormy gusts, but also with thunder, lightning, and great rains, which continue, more or less, until the conclusion of the year.

On the Gold Coast, which extends from Assinee to the River Volta, the wind, in January, begins to blow from the S.W. quarter, and becomes stronger in February, bringing with it sometimes rain, and sometimes a hurricane. About the end of March, and beginning of April, those heavy tempests, called, by the Portuguese, *tornadoes*, arise, accompanied with a deluge of rain, thunder, lightning, and sometimes with earthquakes; these continue to the end of May, and are announced by the darkness of the sky in the S.E.

During the rainy season, that is, in May and July, little or no land-winds are felt: but, from the sea, it blows from the S.W. and W.S.W., making a very great swell, which continues even in August, although the rains begin to cease in that month.

The weather becomes fair in September, and the air clear, with gentle south winds: and this continues till January, the hottest days being in December.

On the Gold Coast, as well as the Windward Coast, an easterly wind, called the *Harmattan*, prevails during the months of December, January, and February. This wind comes on indiscriminately, at any hour of the day, at any time of the tide, at any period of the moon, and continues sometimes only a day or two, sometimes five or six days, and it has been known to last fifteen or sixteen days. There are generally three or four returns of it in every season: it blows with a moderate force, not quite so strong as the sea-breeze, which every day sets in, during the fair season, from the West, W.S.W., and S.W.; but somewhat stronger than the land-wind, at night, from the North and N.N.W. In the *Philosophical Transactions*, Vol. 71, for the year 1781, an account of the *Harmattan* was first given by *Matthew Dobson*, M.D. F.R.S., from the inquiries and observations of *Mr. Norris*, of which the following is the substance:

“On that part of the coast of Africa which lies between Cape Verde and Cape Lopez, a singular periodical easterly wind, named, by the natives, the *Harmattan*, prevails during the months of December, January, and February. Cape Lopez lies to the southward of the line. At the Isles de Loss, which lie to the northward of Sierra Leon, this wind blows from the S.S.E.; on the Gold Coast, from the N.E.; and, at Cape Lopez and the River Gaboon, from the N.N.E.

“The *Harmattan* comes on as above described. A fog or haze always accompanies it, and the gloom is sometimes so great as to render near objects obscure. The sun is thus concealed the greatest part of the day, and appears only a few hours about noon, and then of a mild red colour. At two or three miles from shore, the fog is not so thick as on the beach: and, at 4 or 5 leagues distance, it is entirely lost, though the *Harmattan* is felt for 10 or 12 leagues, and blows fresh enough to alter the course of the current.

“Extreme dryness is a property of this wind. No dew falls during its continuance, nor is there the least appearance of moisture in the atmosphere. All vegetables are much injured, and many destroyed. The seams in the sides and decks of ships become very leaky, though the planks are two or three inches thick. Iron-bound casks require the hoops to be frequently driven tighter, and a cask of rum or brandy can scarcely be preserved: for unless kept constantly moistened, the hoops fly off. The *Harmattan* has, likewise, very disagreeable effects on the skin, lips, and nose, which become sore.

“The effects of the *Harmattan* in evaporation are great; as will appear by the following comparative statement:—At Liverpool, the annual evaporation is about 36 inches, at Whydah, 64 inches; but, under the influence of the *Harmattan*, 133 inches.

“This wind, though so prejudicial to vegetable life, is highly conducive to health; so that fluxes, fevers, small-pox, &c., generally disappear in spite of the doctor; and it contributes to the cure of ulcers and cutaneous eruptions. The baneful effects which have been said to arise from the prevalence of this wind, proceed from the periodical rains, which fall in March, April, &c., and are ushered in by the tornadoes from the N.E. and E.N.E., accompanied with violent thunder and lightning, and very heavy showers. The earth, drenched by these showers, and acted upon by an intense solar heat, so soon as the storm is over, sends forth such noisome vapours, as are the occasion of putrid fevers, and other diseases.

“On this coast, from the middle of February to the first week in March, a wind up the coast, from S.S.W. to S.S.E. prevails for about three weeks. The Tornado season is part of March, all April, and the greatest part of May, about twelve weeks. The rainy season is from the latter end of May, all June, and to about the 20th of July, about eight weeks. Hence, high wind and squally, with very heavy rains, to the middle of August, about three weeks. The rain ceases, and then, for the first three weeks in September, the weather is foggy and close, without any breeze. From this time, for about six weeks, the wind blows fresh down the coast; the tornadoes and southerly wind then succeed, with some rain, generally called the *latter rains*, about four weeks, to the beginning of December, when the *Harmattan* season commences.”

The prevailing winds in the western part of Africa and Gulf of Guinea are distinguished, by the natives, as follow :

AHERRAMANTII, or Harmattan, prevailing about ten weeks, from the 1st of December to the middle of February.

INAKERA, a wind upon the coast from S.S.W. to S.S.E. from the 1st of March to the equinox.

PEMPINA, the tornado season, from March until the end of May, about twelve weeks.

ABRENAMA, June and July, eight weeks, the rainy season, by the natives called the Old Man's, Woman's, and Children's season.

ATUKOGAN. High winds and squalls, with heavy rains to the middle of August, three weeks.

WORROBOKORON. The rains cease, three weeks.

MAWARRAH. Close foggy weather in September, three weeks.

BOUTCH. No land-breeze ; the wind fresh down the coast for six weeks.

ANTROPHI. Frequent tornadoes southerly, some rain, called the latter rains, four weeks, continuing to the beginning of December, when the Harmattan commences.

TORNADOES on the **AFRICAN COAST**, as described by M. Golberry.—“Between Cape Verga and Cape Palmas, and during the months of May, June, July, August, September, and October, the countries near the sea are frequently exposed to hurricanes, which the Portuguese have denominated *tornados*, and which have obtained this name even amongst the negroes. During my stay in the river of Sierra Leon, I witnessed one of these tornadoes, but it was not one of the most violent. These meteors happen a few weeks before the rainy season, and continue till the month of November. The countries above described are, therefore, exposed to them for nearly six months ; and these whirlwinds are more or less frequent, and of different degrees of violence, according to the state of the atmosphere.

“This part of Africa generally experiences ten or twelve of these hurricanes in a year ; and it is easy to describe their effects than to discover their cause. They are characterized by circumstances which deserve all the attention of philosophers.

“The sky is clear, a perfect calm has prevailed for several hours, and the weight of the air is oppressive. Suddenly, in the most elevated region of the atmosphere, is perceived a little round and white cloud, the diameter of which does not appear to exceed 5 or 6 feet : this cloud, which seems to be fixed and perfectly motionless, is the indication of a tornado.

“By degrees, and at first very gradually, the air becomes agitated, and acquires a circular motion. The leaves and plants, with which the land is always covered, rise several feet from the soil ; they keep incessantly moving and revolving around the same spot.

“The negroes, who pass their lives like children, amuse themselves with this rotatory motion ; they follow the turn of the agitated leaves and plants, laugh at their innocent amusement, and announce the approach of the tornado.

“The cloud, which is the indicator of this phenomenon, has now increased in size : it continues to spread, and insensibly descends to the lower region of the atmosphere ; at length, it grows thick and obscure, and covers a great part of the visible horizon.

“By this time the whirlwind has increased, the vessels in the bays double their cables, or drop anchor near the shore ; the tornado becomes violent and terrible ; the cables often break, and the violent agitation of the ships cause them to run foul of each other.

“Many negro-huts are swept away, trees blown up by the roots ; and, when these whirlwinds exert their full violence, they leave deplorable traces of their progress. These meteors happily last only a quarter of an hour, and terminate by a heavy rain.

“The maritime countries to the northward, comprised between Cape Blanco and Cape Verga, are not subject to these phenomena ; it is only to the south of the latter cape, and as far as that of Palmas, that they are felt in their full violence ; and they

always occur at the same periods. Some topographical circumstances, peculiar to this part of Western Africa, are, doubtless, among the number of causes of these whirlwinds.

“Between the tenth and twentieth degree of latitude North, and between the eighth degree of longitude (from Greenwich) and the Atlantic Ocean, there is no spot of ground sufficiently elevated to deserve the name of a mountain. Western Africa begins to be mountainous at Cape Verga, and it continues to rise to the summit of the chain, which bears the name of Sierra Leon: these summits may be considered as the most elevated points of this part of Africa; and its topographical configuration then presenting eminences, which form an obstacle to the course of the winds, and depths in which they may be ingulfed, must contribute to produce such phænomena.”

Other topographic descriptions, by M. Golberry, will be found in the following section of this work.

WINDS on the ATLANTIC ISLES.—The winds upon and near the different islands, in the Atlantic Ocean, are very variable and uncertain, especially where the land is high and irregular. In general, regular sea and land breezes alternately prevail; the sea-breeze by day, and the land breeze by night, as the land is alternately heated and cooled: but the direction of these breezes is varied by the quality and figure of the land, and other local circumstances. If the land be very high, it generally intercepts the prevailing wind, and so affects the air as to produce, on the lee-side, either a calm, a gentle breeze in an opposite direction, or a kind of eddy, which is sometimes very troublesome to shipping. Such is the case under the western part of Madeira, and to leeward of the Canary Islands. The Grand Canary being so high as to stop the current of the N.E. wind, which prevails there; and on the eastern side there is a calm, or a gentle breeze from S.W.

The calms and eddy winds, occasioned by the figure and height of the Canaries, extend from 10 to 30 leagues beyond them to the S.W., according to the height of the respective islands. The boundary of the calms may be seen; for, within them, the water is smooth; without them is the regular undulation of the sea, caused by the general wind; and, at the edge of them, the winds, by setting in opposite directions, produce a breaking of the waves, with a foam, like the billows on a rocky shoal, just beneath the surface of the ocean.

From a consideration of the particulars now described, the cause of those copious dews which fall in the night, on the islands, &c., situated within the tropics, will be apparent. For, as the great power of the sun by day causes an extraordinary evaporation of the ocean, so, in the night, the exhalation, ceasing to retain the same degree of levity acquired from the heat of the sun, becomes, by the absence of the power which produced it, so dense and heavy, as again to fall back to the earth. The air, at the same time, cooling, by the same cause, is also affected by the descending moisture, and thus acquires an additional tendency to increase the land-breeze.

According to Sir Humphrey Davy's theory of mists, land and water are cooled after sunset in a very different manner:—The impression of cooling on the land is limited to the surface, and is very slowly transmitted into the interior; whereas in water, the upper stratum, when cooled, descends, and has its place supplied by warmer water from below. The surface of the water will, therefore, in calm and clear weather, and temperatures above 45° of Fahrenheit, be warmer than the contiguous land; and, consequently, the air above the land will be cooler than that above the water. When the cold air, therefore, from the land mixes with that above the water, both of them containing their due proportion of aqueous vapour, a mist or fog must be the result.

In the CENTRAL PART of the OCEAN, between the Azores and West-India Islands, Mr. Luccock was passing homeward from Brasil, in the year 1816; and, in his 'Notes,' he says, “In this neighbourhood, about latitude 29° N. and longitude 38° W. I felt the greatest degree of cold which I ever experienced; or, to express myself more correctly, I never knew a ship's company so susceptible of the change of temperature as there. It was the 3d of April, 1816. We had passed the equator on the preceding 20th of March. In our run to the northward, the wind had been easterly and the weather hot. The N.E. trades were undoubtedly blowing between us and the coast of Africa, and we were now approaching their northern verge. It was, therefore, natural to suppose that we had suddenly entered into that section or current of air which had recently

passed over the mountains of Atlas, probably at that early period of the year, still covered with snow. If this conjecture be right, it shows that the frosts of these African mountains produce a very sensible degree of coldness at the distance of 1300 miles from them; that the scorched desert also has warmed the atmosphere to the same extraordinary distance from the coast, and that the two lines of the aerial current have run parallel to, and almost without intermingling with, each other.

At JAMAICA the air is, in most places, hot and unfavourable to European constitutions; but the cool sea-breezes, which set in every morning, render the air more tolerable; and that upon the high grounds is temperate, pure, and cooling. It lightens almost every night, but without much thunder; nevertheless, when the latter happens, it is very terrible, and roars tremendously.

On the southern side of the island the sea-breeze from the south-eastward comes on in the morning, and gradually increases, until noon, when it is strongest: at two or three in the afternoon its force diminishes; and, in general, it entirely ceases by five o'clock. About eight in the evening the land-breeze begins: this breeze extends to the distance of 4 leagues to the southward from the island. It increases until midnight, and ceases at about four in the morning.

The sea and land breezes are more regular than otherwise from the latter part of January until May. In the middle of May the sea-breeze generally prevails for several days and nights, especially about the time of full and change of the moon; and thus they continue throughout June and part of July; from that time the sea-breeze diminishes, varies, and veers round to S. by W. or S.S.W., with frequent calms. August, September, and October, are the hurricane months, in which there generally are strong gales of wind, with much rain.

In December, January, and February, when the north winds predominate, their force checks the sea-breeze. The southern coast is that which, of course, is least exposed to these winds, being sheltered, in a great measure, by the mountains. When combined with the land-breeze, they render the air very cold and unhealthy.

During the months of July and August, the sea-breeze about the island generally blows impetuously, and in frequent squalls. At this season, vessels bound hence to Europe would have the most advantageous passage through the Strait and Stream of Florida; but, in October, northerly winds frequently extend over all the Bahamas, Cuba, and, for some time, on the north side of Jamaica: but the current of air is forced upwards by the mountains of the latter, and its strength is spent in the heights. In seasons when it is more impetuous, it rushes through the windings and defiles of the mountains upon the southern coast, particularly in the neighbourhood of Kingston, and has been known to continue for some days.

During the winter, the land-breeze is more general off the shores than in summer; it sometimes continues throughout the day as well as night, and westerly winds prevail over all the space between Jamaica and Cuba, and even to the Island of Hayti or St. Domingo. They have been experienced from Port-Royal, through the Windward Channel; but this is not generally the case.

In November, southerly winds prevail on the south side of the island, and have been known to extend from the Mosquito shore, whence vessels have arrived in five or six days, that might, at other times, have been as many weeks, when beating against the sea-breeze. The southerly winds are generally faint; nor do they come upon the land, until it be heated by the sun, and are often expelled by a fresh land-breeze soon after mid-day, which abates in a few hours.

The return of the sea-breeze, falling sooner or later in autumn, is gradual; first approaching the east end, then advancing a little; and, in some years, it reaches Morant Point fourteen or twenty days before it is felt above Kingston. It also blows for a week or two later on the east end of the island than at Kingston; and has been known, in some years, to prevail there in the day-time during the whole time it was unfelt at the former place.

Notices of various other local winds, on the American Coasts, &c., may be found in the particular descriptions given hereafter.

WINDS THROUGHOUT THE WEST-INDIES.—The following description of the winds prevailing over these regions, in the different seasons, has been extracted from Captain Livingston's translation of the '*Derrotero de las Antillas*,' or Spanish Directory for the West-Indies, mentioned in Note 4, page 53.

"On the Eastern Coasts of America, and among its islands, the course of the general easterly or trade-wind is uninterrupted, though subject to some modifications in direction and force. At a short distance from the land, the sea-breeze calms at night, and is replaced by the land-breeze: this variation happens every day, unless a strong wind prevails from the northward or southward; the first of these being experienced from October to May, and the second in July, August, and September.

"The general easterly wind, of the tropical regions, is felt on the coast of Guyana and on the coasts of the Caribbean and Mexican Seas, but with variations which may be denominated *diurnal* and *annual*. The diurnal period is that which the *sea-breeze* causes, and which strikes the coast usually at an angle of two points, less or more according to the locality and other circumstances; and then the *land-wind*, which, coming from the interior, always blows off shore. The sea-breeze comes on at about nine or ten in the forenoon, and continues while the sun is above the horizon, increasing its force as that luminary augments its altitude, and diminishing, in a similar proportion, as the sun's altitude decreases. Thus, when the sun is on the meridian, the sea-breeze is at the maximum of its strength; and at the time that the sun reaches the horizon, this breeze has, perceptibly, ceased. The land-breeze commences before midnight, and continues until the rising of the sun; sometimes longer. A space of some hours intervenes between the land-breeze's ceasing and the sea-breeze's coming on, during which there is a perfect calm.

"The *annual period* of the trade-wind here is produced by the proximity or distance of the sun, which occasions the only two seasons known in the tropics; the *rainy* and the *dry* seasons. The first is when the sun is in the tropic of Cancer, and heavy rains with loud thunder are prevalent. In this season the wind is generally to the southward of East, but interrupted by frequent calms, yet it occasionally blows with force and obscures the atmosphere.

"When the sun removes to the tropic of Capricorn, the dry season commences, and then the trade-wind, which is steady at N.E., is cool and agreeable. At this season, North and N.W. winds are sometimes found, blowing with much force; and, indeed, in some degree, they regularly alternate with the general wind, as they are more frequent in November and December, than in February and March.

"In the change of the seasons there is a remarkable difference; for, in April and May, no change is experienced in the atmosphere, and the weather is, in general, beautifully fine; but, in August, September, and October, there are usually calms, or very light winds: and dreadful hurricanes, in these months, sometimes render the navigation perilous. From these perils, however, are exempted the Island Trinidad, the coasts of Colombia, (late Terra Firma,) the Gulfs or Bays of Darien and Honduras, and the Bight of Vera Cruz, to which the hurricanes do not reach. In the space of sea between the Greater Antillas* and the coast of Colombia, the general N.E. or trade-wind regularly prevails; but, near the shore, the following peculiarities are found:

"At the GREATER ANTILLAS the sea-breeze constantly prevails by day, and the land-breeze by night. These land-breezes are the freshest which are known, and assist vessels much in getting to the eastward or remounting to windward, which, without them, would be almost impossible. At the Lesser Antillas, as Dominica, Martinique, and St. Lucia, &c., there are no land-breezes.

"On the COASTS of GUYANA there are no land-breezes, nor more wind than is generally experienced between the tropics. In January, February, and March, the winds here blow from North to E.N.E., and the weather is clear. In April, May, and June, the winds are from East to S.E. In July, August, and September, there are calms, with tornadoes from South and S.W.; and, in October, November, and December, there are continual rains, while the sky is, in general, obscured by clouds. In the dry season, which is from January to June, the heat is very great; and, in the wet season, rains and thunder are constant and violent.

"On the COASTS of CUMANA and CARACCAS, to Cape la Vela, the breeze follows the regular course; but from that cape to Cape San Blas the general wind alters its direc-

* Cuba, Jamaica, Hayti, and Porto-Rico.

tion; for it blows from N.E. or N.N.E., excepting in the months of March, April, May, and June, when it comes to E.N.E., and is then so uncommonly strong as to render it necessary for vessels to lie-to. These gales, which are well known to mariners, extend from about mid-channel to within two or three leagues of the coast, where they become weak, especially at night. On this coast, about the GULF of NICARAGUA, are westerly winds, which the pilots of that country call *Vendavales*, (rainy winds,) in the months from July to December; but these winds never pass the parallel of 13° N., nor do they blow constantly, but alternate with the sea-breeze.

“Upon the MOSQUITO SHORE, HONDURAS, and EASTERN COAST of YUCATAN, the general winds or breezes prevail in February, March, April, and May; but, during the first two of these months, they are occasionally interrupted by *norths*. In June, July, and August, the winds here are from the eastward and westward of South, with tornadoes and calms. In September, October, November, December, and January, they are from the northward or southward of west, with frequent gales from W.S.W., W.N.W., and North.

“On the NORTHERN and WESTERN COASTS of YUCATAN, between Cape Catoche and Point Piedras or Desconocida, and thence to Campeché, there is no other than the N.E. or general wind, interrupted by hard norths in the season of them; and, about the end of April, tornadoes commence from N.E. to S.E. These tornadoes generally form in the afternoon, continue about an hour; and, by nightfall, the serenity of the atmosphere is re-established. The season of the tornadoes continues until September, and in all the time there are sea-breezes upon the coast, which blow from N.N.W. to N.E. It has been remarked that, as the sea-breeze is the more fresh, the more fierce is the tornado, especially from June to September. The sea-breezes come on at about eleven of the day; and at night the wind gets round to East, E.S.E., or S.E., so that it may be, in some degree, considered as a land-breeze.

“On the COAST of the MEXICAN SEA, from VERA CRUZ to TAMPICO, the breeze from E.S.E. and East prevails in April, May, June, and July; and, at night, the land-breeze comes off from South to S.W.: but, if the land-breeze is from the N.W. with rain, the wind, on the day following, will be from North, N.N.E., or N.E., particularly in August and September: these winds are denominated, in the country, ‘*Vientos de Cabeza o Vendavales*’ (head-winds or rainy winds); they are not strong, nor do they raise the sea; with them, therefore, a vessel may take an anchorage as well as with the general breeze, but they impede getting out, for which the land-breeze is required. The *Vientos de Cabeza*, or head-winds, reach to about 20 or 30 leagues from the coast, at which distance are found those at East and E.S.E.

“From the middle of September until the month of March, caution is necessary in making VERA CRUZ, for the norths are then very heavy. The narrowness of this harbour, the obstruction formed by the shoals at its entrance, and the slender shelter it affords from the norths, render an attempt to make it, during one of them, extremely dangerous, for it will be impossible to take the anchorage. The following description of the winds here has been written by Don Bernardo de Orta, a captain in the Spanish navy, who has been captain of the Port, and who surveyed it.

“Although in the Gulf of Mexico we cannot say that there is any other constant wind than the general breeze of this region, notwithstanding that, from September to March, the north winds interrupt the general course, and, in some degree, divide the year into two seasons, *wet* and *dry*, or of the *Breezes* and *Norths*: the first, in which the breezes are settled, is from March to September; and the second, in which the norths blow, is from September to March. For greater clearness we shall explain each separately.

“The first of the Norths is regularly felt in the month of September; but, in this month and the following one, October, the norths do not blow with much force. Sometimes it happens that they do not appear; but, in that case, the breeze is interrupted by heavy rains and tornadoes. In November the Norths are established, blow with much strength, and continue a length of time during December, January, and February. In these months, after they begin, they increase fast; and in four hours, or a little more, attain their utmost strength, with which they continue blowing for forty-eight hours; but afterwards, though they do not cease for some days, they are moderate. In these months the Norths are obscure and north-westerly, and they come on so frequently, that there is, in general, not more than four or six days between them. In March and April they are neither so frequent, nor last so long, and are clearer, but yet they are more fierce for
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the first twenty-four hours, and have less north-westing. In the interval before November, in which, as we have said, the *Norths* are established, the weather is beautiful, and the general breeze blows with great regularity by day; the land-breeze as regularly by night.

"There are various signs by which the coming on of a *North* may be foreseen: such are, the wind steady at South; the moisture of the walls, and of the pavements of the houses and streets; seeing clearly the Peak of Orizaba and the Mountains of Perote and Villa-Rica, with the cloud on those of St. Martin, having folds like a white sheet; the increase of heat and of dew; and a thick fog, or low scud, flying with velocity to the southward: but the most certain of all is the barometer; for this instrument, in the time of the *Norths* at Vera-Cruz, does not vary more, between its highest and lowest range, than $\frac{1}{10}$; that is to say, it does not rise higher than 30 inches $\frac{1}{10}$, nor fall lower than 29 inches $\frac{1}{10}$. The descent of the mercury predicts the *Norths*; but they do not begin to blow the moment it sinks, which it always does a short time before the north comes on: at these times lightnings appear on the horizon, especially from N.W. to N.E.; the sea sparkles; cobwebs are seen on the rigging, if by day: with such warnings trust not to the weather, for a *North* will infallibly come on.

This wind, generally moderates at the setting of the sun; that is, it does not retain the same strength which it had from nine in the morning to three in the afternoon, unless it commence in the evening or at night, for then it may increase otherwise. Sometimes it happens that, after dark, or a little before midnight, it is found to be the land-wind, from the northward and westward; in which case, should it get round to the southward of west, the north will be at an end, and the general breeze will, to a certainty, come on at its regular hour: but, if that does not happen at the rising of the sun, or afterwards, and at the turn of the tide, it will return to blow from the north, with the same violence as on the day before, and then it is called a *Norte de Marea*, or *Tide-North*.

"The *Norths* also sometimes conclude by taking to the northward and eastward, which is more certain; for, if the wind in the evening gets to N.E., although the sky remain covered the day following, but by night the land-breeze has been from the northward and westward, the regular breeze will surely ensue in the evening, good weather succeeding and continuing for four or six days; the latter period being the longest that it will last to, in the season of the *norths*: but, if the wind retrograde from N.E. to N.N.E. or North, the weather will be still unsettled.

"Examples are not wanting of *norths* happening in May, June, July, and August, at which times they are most furious, and are called *Nortes del Museo Colorado*; the more moderate are called *Chocolateros*, but these are rather uncommon.

"The Wet Season, or Season of the Breezes, is from March to September: the Breezes, at the end of March and through the whole month of April, as already explained, are, from time to time, interrupted by *Norths*, and are from E.S.E. very fresh; the sky sometimes clear, at other times obscure. At times these touch from S.E., and continue all night, without giving place to the land-breeze, which prevails, in general, every night, excepting when the north wind is on. The land-breeze is freshest when the rains have begun.

"After the sun passes the zenith of Vera Cruz, and until he returns to it, that is, from the 16th of May to the 27th of July, the breezes are of the lightest description; almost calms, with much mist or haze, and slight tornadoes. After that time, the pleasant breezes from N.W. to N.E. sometimes remain fixed.

"From the 27th of July to the middle of October, when the *Norths* become established, the tornadoes are fierce, with heavy rains, thunder, and lightning: those which bring the heaviest winds are from the east, but they are also those of the shortest duration.

"In the season of the Breezes, the total variation of the barometer is $\frac{1}{10}$; the greatest ascent of the mercury is to 30 inches $\frac{1}{10}$, and its greatest descent to 29 inches $\frac{1}{10}$. The thermometer in July rises to 87° , and does not fall to $83\frac{1}{2}^{\circ}$: in December it rises to $80\frac{1}{2}^{\circ}$ but never falls below $66\frac{1}{2}^{\circ}$. This, it must be understood, was ascertained in the shade, the instrument being placed in one of the coolest and best ventilated halls in the castle.

"In the months of August and September, rarely a year passes without hurricanes near Florida and the northern Antillas; but to Vera Cruz, or any part of the coast thence to Campeché, they never arrive; all that is felt being the heavy sea, which has arisen in the higher latitudes. Hurricanes begin to the northward and eastward; and, although they do not always go round the same way, yet, in general, they next go to the southward and eastward, with thick squally weather and rain."

From TAMPICO to the BAY of SAN BERNARDO, breezes, from the southward and eastward, are steady and pleasant from April to August; but, in the remaining months this coast is much exposed to gales from East and E.S.E., which blow without intermission, for two or three days, before a North comes on. In about latitude $26\frac{1}{2}^{\circ}$, there are land-breezes in the summer, which blow from midnight until nine in the forenoon.

From the BAY of SAN BERNARDO to the MISSISSIPPI there are land-breezes (*Madrugada*) in the early part of the morning, but after day-light the wind comes to S.E. or E.S.E., and generally in the evening it is from the S.W. In winter the south winds are most stormy, and blow for two or three days together. The most dangerous months for navigating these seas are August, September, October, and November, in which there are hurricanes and traverse winds, (winds blowing dead on shore,) which are so heavy, that a vessel under them cannot carry sail. Upon the Missisipi, and all about its entrance, fogs are thick and frequent; particularly in February, March, and April.

From the Missisipi to the parallel of 28° , the breezes from the northward and eastward, or southward and eastward, prevail in the mornings of the months from April to July, and in the afternoon the wind changes to S.W. These are called the '*Virazonas*,' or *Turnings*. There are storms in August, September, and October, the season in which also are the strongest souths and hurricanes. From November to March, the Norths prevail: they begin at S.E. and South, with much rain, pass to S.W. and West, whence they blow with much force, and remain until they chop round to N.W. and North, after which the weather becomes serene.

From the Gulf, in the parallel of 28° , to the Eastern Keys of Florida, the breezes or general winds prevail until mid-day, when the sea-breeze sets in during the summer; but, in the winter, and especially from November till March, the winds are from the southward and eastward, and raise much sea.

In the Strait of Florida, the breezes are the prevailing winds, but they are interrupted by Norths in the winter, and by calms in summer. Although the northern limit of this channel is within the boundary of the breezes, or trade-wind, it is necessary to remember that, in winter, or from November to April, the variable winds from the southward and eastward and southward and westward, are met with in latitude 27° , and even before: and, in summer, from May until September, the winds in the whole channel are variable from the southward and eastward and southward and westward.

WINDS ON THE NORTH-AMERICAN COASTS.—To the southward of Newfoundland, shifts of wind are very common, and it frequently happens that, after blowing a gale upon one point of the compass, the wind suddenly shifts to the opposite point, and blows equally strong. It has been known that, while one vessel has been lying-to, in a heavy gale of wind, another, not more than 30 leagues distant, has, at the very same time been in another gale, equally heavy, and lying-to, with the wind in quite an opposite direction.

In the year 1782, at the time the *Ville de Paris*, *Centaur*, *Ramillies*, and several other ships of war, either foundered, or were rendered unserviceable, on or near the Banks, together with a whole fleet of West-Indiamen, excepting five or six, they were all lying-to, with a hurricane from West; the wind shifted in an instant to East, and blew equally heavy, and every ship lying-to, under a square course, foundered.

The winds within the Gulf are not so liable to sudden shifts as on the outside, or to the eastward, of Breton Island. The weather to the southward of the *Magdalen Islands*, between them and Prince Edward Island, is generally much clearer than on the north.

WINDS ON THE COAST OF SOUTH-CAROLINA, &c.—Remarks by Mr. Geo. Walker.—About this coast, if the wind blows hard from the N.E. quarter, without rain, it commonly continues so for some time, perhaps three or four days; but, if such winds are attended with rain, they generally shift to the E., E.S.E., and S.E. South-east winds blow right in on the coast; but they seldom blow dry, or continue long: in 6, 8, or 10, hours after their commencement, the sky begins to look dirty, which soon produces rain. When it comes to blow and rain very hard, you may be sure the wind will fly round to the north-west quarter, and blow hard for twenty or thirty hours, with a clear sky.

North-west winds are always attended with clear weather; they sometimes blow very hard, but seldom for longer than 30 hours. The most lasting winds are those which blow from the S.S.W. and W.N.W., and from the North to the E.N.E. The weather is most settled when the wind is in any of these quarters.

In summer-time, thunder-gusts are very common on this coast; they always come from the north-west quarter, and are sometimes so heavy, that no canvas can with-

stand their fury : they come on so suddenly, that the greatest precaution is necessary, to guard against the effects of their violence.

Of the thunder-gusts, Captain Walker has said : The first indication of them is a black heavy cloud, the weather sultry, little wind, and variable. I advise, at the appearance of these warnings, not to stay to reef, but clue up every sail, except the foresail and foretopmast-stay-sail, and your ship will be ready to veer ; if you have time to hand the sails clued up, do it, but it seldom happens that you have, as these gales come on suddenly. A shocking accident happened to a brigantine in company with me, off Cape Hatteras, in the year 1773 : a little before the squall reached them, they attempted to reef, and, in the time of reefing, the vessel overset, and all perished.

The same gentleman, in his description of the Coast in the vicinity of St. Augustin, has stated : From the 1st of November to the last of February, the hardest gales prevail that blow on this coast : and in general from the N.N.E. to the S.S.E., the wind any way easterly comes on very suddenly to a gale during the season above mentioned ; and these gales give but very little warning. In the year 1777, I had the charge of His Majesty's ship the *Lively*, and was then at anchor in St. Augustin Bay, when it came on to blow at E.N.E., and in fifteen minutes time I was obliged to slip, and, had we not carried sail to the utmost, we should not have cleared the land to the southward.

When the wind backs against the sun, with a small rain, you will perceive the sea to rise before the wind comes ; then prepare for a gale, which, in general, will last 50 or 60 hours. If you should be obliged to cut or slip, carry all the sail you possibly can, to get an offing before it increases, so as to put you past carrying any sail, which is always the case ; and observe that, the flood-tide setting to the southward will be of no service to you farther out than in 12 fathoms of water, when you will be in the southern current until you get into 46 fathoms, which is about 15 leagues from the land. Then you will be in the Gulf-Stream, issuing out of the Strait of Florida, and which runs strongly all along the edge of soundings.

BERMUDAS' ISLES.—Near these islands, as shown hereafter, hurricanes and tempests are very frequent ; but the prevailing winds, with fine weather, are from between the South and West. Hakluyt, in his voyages, 1598, calls the sea about the Bermudas a "hellish place for thunder, lightning, and storms ;" and another writer, in 1615, describing the arrival of the English at these islands in 1609, has said, "Sir George Somers, sitting at the sterne, seeing the ship desperate of relief, looking every minute when it would sinke, he espied land, which, according to his and Captain Newport's opinion shou'd be that dreadful coast of the Bermodes, which islands were, of all nations, said and supposed to be enchanted, and inhabited with witches and devils ; which grew by reason of accustomed monstrous thunder, storme, and tempest, neere unto those islands ; also for that the whole coast is so wondrous dangerous of rockes, that few can approach them but with unspeakable hazard of shipwreck." We now laugh at this : knowing that the mild and regular climate of these islands is preferable even to that of Madeira, and to be preferred for the purity of its air, together with the abundance and quality of fruits and vegetables.*

HURRICANES.

WE shall conclude this division with the description of a hurricane in the West-Indies, from the pen of an ingenious and experienced navigator.

In the months of August, September, and October, these dreadful tempests are to be expected, which, in an instant, spread destruction around, and render it impossible to set any sail whatever, scarcely giving time to secure the masts and hatchways before it reaches its meridian violence. The following description of a ship in a hurricane is a real fact, which happened at Jamaica many years ago, and ought to be a warning to commanders in preparation for so dreadful a situation.

This ship, of the Royal Navy, was lying in Bluefields, on the S.W. side of Jamaica, with one-third of a cable on the small bower, with top-gallant yards across, between the hours of three and four *p.m.*, when it came on to blow, and gradually increased till six, when it blew very hard. The steps which were now taken were somewhat singular, and such, perhaps, as a seaman would little think of :—In place of the necessary preparations for blowing weather, and giving the ship more cable, another anchor was let go

* See Capper on Winds and Monsoons, page 177.

under foot (top-gallant yards still across.) At seven she parted the small bower, took the best on her shoulder, and drove off the bank. Now, getting down top-gallant yards was thought of, and performed with hazard and difficulty; the ship lying along in such a manner that the main-deck guns touched the water; the top-gallant masts were attempted to be struck, but too late, the gale raging now so violently that no man could go aloft; the best bower was hove up, but, not being able to secure it, the cable was soon cut, and anchor let go. All the necessities for battening down the hatches were to look for; the gratings were, however, after much trouble, mustered from the different parts of the ship, and the hatches battened down. But this essential piece of service was neglected so long, that it now required unceasing efforts at the pumps to free the ship from the water she had taken in through the hatchways. She was now nearly on her beam-ends, while the astonishing violence of the wind, at the time, almost rendered ineffectual the exertions of the carpenters and seamen, who had to contend with the warring of the elements, heightened by the surrounding horrors of rocks and shoals, and a night as dark as Erebus.

The hurricane was now, beyond description, dreadful. Its action was like that of fire: every thing disappeared that opposed it; notwithstanding the size and solidity of the masts, powerfully supported by the shrouds, they were no longer able to resist its unremitting fury; the mizen-mast went first; in about three minutes after, the main-mast followed; and, instantly after, went the fore-mast and bowsprit. This most dreadful situation is, to the seamen's imagination, more easily pictured than described; terror and astonishment, for a moment, occupied every mind; but this inactive stupidity was soon removed by that intrepid boldness and indifference to danger, so eminently the characteristic of British seamen, and the wreck cleared with wonderful alacrity. About this time the wind chopped round to the southward, and raised a tremendous sea; by which the tiller was carried away, but soon replaced. The ship continued to drift all night, with the pumps going incessantly: at day-break, the land was seen under the lee, about 2 miles distant; high steep rocks, the aspect more than any thing dreadful; hardly a hope remained of saving the ship; the wind, though somewhat abated, blew with great violence dead on shore; the fore-mast, on which was hoisted a mizen top-sail, was about 1½ feet above deck; the stumps of the main and mizen-masts were nearly of the same height: upon these the people were employed, getting sails set, when the wind providentially shifted to east, which, co-operating with a rapid current, cleared the ship of the rocks, which she passed at the distance of about 2 cables' length.

Let us now examine whether the dreadful effects of this tremendous hurricane might not have been lessened by precautions, particularly as the gale came on gradually.

In the first place, the top-gallant yards should have been got down, and the masts struck, when the gale was found to increase, or even before, as the event, at this season, might be expected; the topsail-yard should have been sent down on deck, and the top-masts lowered close down, and their heels secured; the rigging made snug in the tops, the spritsail-yard and jib-boom in, the cross-jack and mizen-yards lowered down, down-haul tackles fixed to the fore and main-yards, to get them down and secure them to the gunwale; the shrouds well swifted, the booms and boats well frapped, the hatchways secured, the lower-deck guns double-breeched, lowered, and muzzle-lashed; the spare tiller at hand, and relieving-tackles in the gun-room; the forelocks of the main-deck, quarter-deck, and forecastle, guns loosed ready, in case it should be necessary to heave them overboard, as was the case with H.M.S. Hector, in the year 1780, in a similar hurricane.

Had the above precautions been taken, it is reasonable to suppose, that the danger would have been less imminent, and that confusion prevented, which must ensue when every thing is to be done at once.

Hurricanes are seldom experienced beyond the tropics, or nearer to the equator than the latitude of 9 or 10 degrees.

WATERPOUTS.

The well-known phenomenon, called a *WATERPOUT*, which is frequently seen on the Atlantic, proceeding from black dense clouds, always appears in warm weather, generally in calms, or with little wind; but they have been seen during a fresh gale. It has been shown, by the celebrated Dr. Franklin, and other writers, that a whirlwind on land, and a waterspout at sea, arise from the same general causes; and may be considered as one

and the same. At sea they are commonly harmless, unless ships happen to be immediately under them; but if, in the progressive motion of the whirl, it passes from the sea over the land, and there suddenly breaks, violent and mischievous torrents are the consequence. At sea, after the spout breaks, the water descends in the form of very heavy rain. Small vessels, however, may be upset, if they have much sail out; and large ships, if their top-masts be not clued up, and the yards secured, may have them carried up to the mast-heads by the force of the whirl, and thereby lose their masts. It is generally believed, that the firing of a shot through a waterspout will break it, and effect a dispersion. In the vicinity of a spout, the wind commonly flies round in sudden gusts; and all ships should therefore take in their square-sails.

That a waterspout and whirlwind are identical, has been amply demonstrated by those who have seen this meteor pass from the sea to land, and the contrary. They have both a progressive as well as circular motion; they usually appear after calms and great heats, and mostly happen in the warmer latitudes.

The following description of a WATERSPOUT, seen during a fresh gale, upon the coast of North-America, was written by the late Mr. Murdo Downie.

"Upon the forenoon of the 9th of October, 1795, while cruising in his Majesty's ship *Resolution*, of 74 guns, (then bearing the flag of the late Admiral Murray,) in company with H.M.S. *Africa*, of 64 guns, commanded by the late Admiral, then Captain, Home, in latitude 32° , and longitude $66\frac{1}{2}^{\circ}$ W. having the wind at N.N.E. blowing a fresh gale, and the ship steering by the wind east for the islands of Bermudas, we were surprised with a waterspout, formed in an instant, directly to leeward, at about two miles, or little more, distant. Both the *Africa* and we fired several 18-pound shot at it, which fell a little short; and, although some of the shot fell very near, yet they had no visible effect upon it. Its appearance was that of a long slender pillar, with the upper end spreading into a large dense cloud, of which it seemed to form a part, and the lower end reached to within about 20 or 30 feet of the sea, where it was obscured from the sight by the water's being violently thrown up and agitated, so as to resemble a number of fountains or water-engines playing perpendicularly round the lower end of the spout. The pillar became more transparent in proportion as it decreased in size from the cloud downward, until at the lower end, where it was almost perfectly so; and a small column, of an equal diameter, and more transparent than the rest, appeared up through the middle, so that about the lower end it resembled an empty glass tube in appearance, from thence the transparent column in the middle became gradually obscured, the higher up, by the opacity of the outside, until it altogether disappeared near the cloud. The spout appeared at its full size, or nearly so, when first seen, and began to decrease shortly after, and turning gradually smaller, it in a short time vanished in a slight shower.

"We were too intently gazing at this extraordinary phenomenon to mark the exact time it lasted, but supposed it to continue 10 or 15 minutes; and its distance from the ship was pretty accurately ascertained by the shot fired at it nearly reaching; but, what appeared most remarkable was, that, although the wind blew so strong a gale, that the ship could carry only reefed topsails, (from which the velocity of the wind cannot be estimated at less than 30 or 40 miles an hour,) yet the waterspout seemed to move but very little from the place where it was first seen. The ship was going at the rate of $5\frac{1}{2}$ miles an hour, and increasing her distance from the spout; yet, after continuing the above-mentioned time, it was considerably within the verge of the visible horizon, as seen from the quarter-deck, when it vanished, (as upon the quarter-deck the eye was elevated 23 feet above the surface of the sea, the horizon would therefore be seen about 6 miles distant :) now, allowing the ship to have increased her distance from the spout half a mile during its continuance, and that it vanished a mile within the verge of the visible horizon, which, together with 2 miles it was distant when first seen, will make in all $3\frac{1}{2}$ miles, which taken from 6 miles, (the distance of the visible horizon,) leaves $2\frac{1}{2}$ miles for the spout to move in 10 minutes; whereas the wind must have gone at least 5 miles in that time, and consequently $2\frac{1}{2}$ miles faster than the waterspout. Indeed it is very probable the waterspout did not move so much, in proportion to the wind, as the above calculation gives the least difference between their motions that could have been allowed from the observations: the intention of this calculation being principally to prove that the waterspout in some measure resisted the force of the wind.

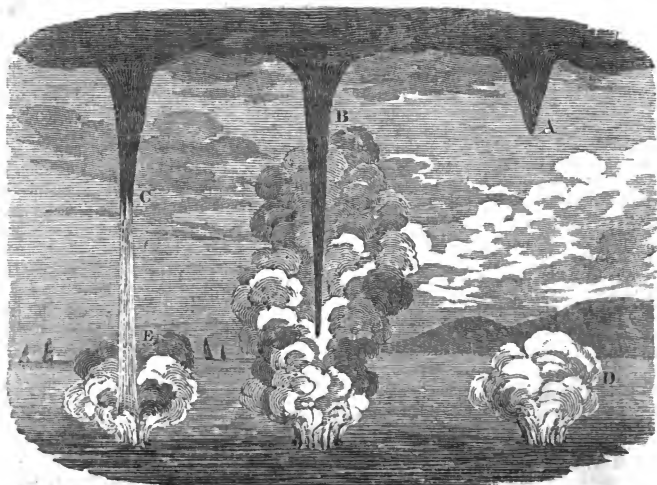
"I have always observed, that waterspouts, lightning, and other electrical phenomena, are far less frequent toward the middle of the ocean than they are upon the land

land, or near it; and when they happen upon the sea, the cloud that contains them is generally observed to have come from off the land; from which reason we find that electrical phenomena are more frequent, and are found to reach to a greater distance, upon the sea bordering the East coast of North-America, than upon that bordering the West coast of Europe, because of the prevailing westerly winds carrying the clouds charged with electric fluid off the land upon the sea near the American coast; whereas upon the European coast these winds confine the clouds upon the land. It is also a known fact, that, within the limits of the N.E. trade-winds, and half-way between the Cape Verde and Windward West-India Islands, more especially in the latitude of these islands, that scarcely any of these electrical appearances ever happen; whereas upon the shores of Africa and America, in the same climate, they frequently rage with great fury."

For the description of another Waterspout, at the distance of 44 leagues to the S.E. o the Bermudas, seen by the Hon. Capt. Napier, R.N. in Sept. 1814, vide our Memoir, &c on the Ethiopic or Southern Atlantic Ocean, page 67.

DESCRIPTION of WATERSPOUTS, by the late MR. GEO. MAXWELL.

"There can be no doubt that Waterspouts have, in most cases, been accompanied with electrical phenomena; and it is equally certain that the spiral and ascending motion of the water has been produced by a gyratory movement in the air, arising from the meeting of two opposite winds. Mr. Maxwell had opportunities, during several voyages to the Congo, of frequently witnessing this interesting phenomenon, and in a drawing, from which the subjoined figure has been made, he has represented the different states of a waterspout, as they most commonly occur.



At their first formation, Mr. Maxwell says, they appear as at A, where the black cloud drops from a level surface into a conical form, before the disturbance at the surface of the sea, as shown at D, is observed. The effect produced at D is like that of a smoking furnace. The black conical cloud now continues to descend, as shown at B, till it almost reaches the surface of the sea, and the smoke-like appearance rises higher and higher, till it forms an union with the cloud from which the spout appears to be suspended. In this condition it is said to put on its most terrific appearance to the mariners who have the misfortune to be in its neighbourhood. When the spot begins to disperse, it assumes the appearance shown at C. The black cloud generally draws itself up in a ragged form, but leaves a thin transparent tube, C E, which reaches to the water, where the smoke-like commotion still prevails. Mr. Maxwell observed, at this time, in the upper part of the tube, a very curious motion.

This singular fact, of the existence of a transparent tube, confirms a description, by Mr. Alexander Stewart, of waterspouts which he saw in the Mediterranean, in 1701. "It was observable of all of them, but chiefly of the large pillar, that, towards the end, it began to appear like a hollow canal, only black in the borders, but white in the middle; and though, at first, it was altogether black and opaque, yet one could very distinctly perceive the sea-water to fly up along the middle of this canal as smoke does up a chimney, and that with great swiftness, and a very perceptible motion; and then, soon after, the spout or canal burst in the middle, and disappeared by little and little; the boiling up and the pillar-like form of the sea-water continuing always the last, even for some considerable time after the spout disappeared, and perhaps till the spout appeared again, or re-formed itself, which it commonly did in the same place as before, breaking and forming itself again several times in a quarter or half an hour."

Phil. Trans. 1702.

Captain Wm. H. Smyth, in his interesting volume on Sicily and the Sicilian Islands, has noticed that "waterspouts and various singular meteoric phenomena occur in that neighbourhood. Among the latter, on a warm cloudy and hazy day, the 14th of March, 1814, it began to rain in large drops, that appeared muddy, and they deposited a very minute sand of a yellowish red colour. The wind, on the day before, had been blowing strongly from the S.S.W. to the N.E.; and, during the time the rain fell, was from the S.W., which leads to a supposition that it was transported from the Deserts of Africa." This remark accords with a number of others on the sand from the *Sahara*, or *Desert*, which is carried by the wind over the Atlantic, to an almost incredible distance from the western coast.

2.—OF THE TIDES.

As introductory to a General Table of the Tides, we shall give a few passages from *M. Malte-Brun*, explanatory of the subject.

The water of the sea yields to the slightest impression: and, although its density and weight combine to retain it in a constant equilibrium, it is agitated, to a certain depth, by rapid and varied motions. These motions may be classed according to the manner in which the particles move, and according to the nature of the agents which cause the motion.

Three kinds of motion may be distinguished in the sea, considered in reference to their causes. The TIDES are *sidereal motions*, because they depend upon the influence of the heavenly bodies. *General Currents*, and the greatest number of *Particular Currents*, have their causes in the very element that is agitated by them; these then are *motions of the sea itself*. The third kind comprehends *atmospherical motions*, produced by the action of the winds.

In the water of the Ocean we may distinguish three beds or strata, one above the other, but without any constant limit; the first, agitated by the winds, is the bed or *stratum of undulations*; immediately beneath this is the *stratum of currents*; and lastly beneath is the *immovable stratum*, where the density of the particles from pressure, and from their adherence to the globe, and from friction, prevents all motion.

The motions of the air, or winds, produce corresponding motions on the surface of the water. Unequal and violent winds give rise to *waves* which tower aloft like foaming mountains, roll, rebound, and dash against each other: one moment they seem to bear on their surface the goddesses of the sea, who come to sport in the dance; the next they are involved in the fury of the tempest, they appear to swell with rage, and present to the imagination the monsters of the deep, contending in wrath. A strong, constant, and equal, wind, produces long ridgy *waves*, which all rise, as it were, with the same front, push forward with uniform velocity, and precipitate themselves, in regular succession, on the shore. Sometimes the waves, suspended by a gust of wind, or arrested by a current, form a kind of liquid wall, to the imminent danger of the navigator.

All these oscillations arise from a current of air, which, by dislodging a certain portion of the waters, has destroyed the equilibrium which, every moment, they endeavour to

recover. These motions are similar to those of a pendulum, and they affect only the surface of the waters. The divers assure us that, in the greatest tempest, calm water is found at the depth of 90 feet.

We must distinguish the *waves* produced by the momentary action of the wind, and those which arise from the impulse communicated by a preceding wind, or by a current, or by any other cause. This double oscillation, which contributes to augment the agitation of a vessel, is often experienced.

THE TIDES are regular and periodic oscillations, which the seas undergo from the attraction of the celestial bodies, principally those of the moon and sun.

Action of the Moon.—Let us first consider the single action of the moon upon the sea; supposing that luminary to be in the plane of the equator. It is evident that, if the moon exerted upon all the particles of the sea an equal attraction, and parallel to the earth's centre of gravity, the entire system of the globe, and of the waters which cover it, would be influenced by a common motion, and their relative equilibrium would not suffer any change. This equilibrium is disturbed only by the difference between the attractions which the moon exerts, and the inequality of their directions. Some parts of the globe are *directly* attracted by the moon; others only obliquely. The former are in conjunction with the moon; and a line drawn from the centre of the two planets would pass through their zenith. The latter are in quadrature with the moon; that is to say, a line drawn from the terrestrial centre to their zenith, would make an angle of 90 degrees with the line which connects the centres of the two planets. The attracting force acting obliquely is decomposed by the obliquity of its angle of incidence; thus the parts in conjunction being more strongly attracted than those in quadrature, the weight of their particles is diminished. It is necessary then, to there being an equilibrium in all parts of the sea, that the waters should rise under the moon, in order that the excess of weight of the particles in quadrature, above those in conjunction, may be compensated by the greater height of the latter.

The waters however, rise, not only on the side where the attracting planet is, but, also, on the opposite side; because, if the planet attracts the superior waters more than it attracts the centre of the earth, it also attracts this centre more than it attracts the inferior waters in the opposite hemisphere. These waters will then approach less toward the attracting planet, than the centre of the earth approaches to it. They will remain as far off, from and behind the centre, as the superior waters advance from it on the side of the moon.

Two promontories, or eminences of water, will therefore be formed by the action of the moon upon the earth:—one on the side towards the moon, the other on the side opposite to it, which gives the sea an appearance of an elongated spheroid, whose great axis will pass through the centre of the moon and of the earth. It is *high tide* under the moon and in the opposite point: ± 180 degrees of distance; consequently, in the two intermediate points, or at 90 degrees of distance from the moon, the tide will be *low*.

The Earth, by its rotatory motion, successively presents to the moon, in the space of 24 hours, all its meridians, which, consequently, are found by turns, and at an interval of six hours, sometimes under the moon, and sometimes at a distance of 90 degrees from it: hence it follows that, during the time which passes between the departure of the moon from one meridian, and its return to the same meridian, that is in the space of a lunar day, which exceeds the solar day by about $50\frac{1}{2}$ minutes, the waters of the sea will ebb twice, and flow twice, in every part of the Earth, although in a manner almost insensible in those places which are distant from the path or orbit of the moon.

The Earth, in revolving upon its axis, carries along with it, to the eastward of the moon, the promontories, or the most elevated portions of water; these, therefore, will still continue to rise by the action of the moon; and, although that action, already less direct, is diminishing in force every moment, yet it subsists, and continues to combat with the inertia and friction which retard the elevation. It is from this reason that the elevation does not attain its *maximum* at the very moment of the moon's passing the meridian, but about three hours after.

A second cause tends to produce the same effect. The waters placed in quadrature, on the west of the moon, and carried towards conjunction with that planet, by the

rotatory motion of the earth, will be continually accelerated during the quarter of the day when they are in this position, and will move after the syzgies, or conjunction, with the sum of these accelerations, and then meeting with particles continually more retarded than the earth, they will form two contrary currents, which will place the greatest elevation at about 45 degrees past the syzgies. From the like reason the greatest depression of the water will not happen at the quadrature, but three hours after, and at 45 degrees from that point.

Action of the Sun.—If we now imagine the Sun to be in the plane of the equator, it is evident that, as its action is similar to that of the moon, it should excite in the ocean an agitation similar to the lunar tides. Thus the sea would ebb twice and flow twice during a solar day; but, on account of the immense distance from the sun, these solar tides will be much smaller than those which result from the action of the moon. According to *Lalande*, the influence of the moon is $2\frac{1}{10}$ times greater than that of the sun. *Laplace* considers it even triple.

On account of the inequality which exists between the solar and lunar days, the action of the sun will sometimes change the position of the lunar tides, and at other times will unite its influence with that of the moon. In the syzgies, or conjunctions, the action of the moon concurs with that of the sun to raise the waters. This is the reason why the highest tides happen at new and full moon; or when the moon is in its first and third quarters. In the quadratures, the waters of the sea are depressed by the action of the sun, at the same point where the action of the moon raises them, and reciprocally. Thus the tides of the quadratures ought to be less. But the highest tide does not, and should not, happen precisely on the day of the new and full moon, but two or three days after. The reason of this is, that the motion once acquired is not all at once destroyed; it continues to augment the elevation of the waters, although the instantaneous action of the sun is, in reality diminished.

What we have already explained regards the position of the sun and moon in the equator. Let us now consider these heavenly bodies in their various declinations, and we shall see the elevation vary in the inverse ratio of the cube of the distance of the water.

Without entering into details, which would require mathematical demonstrations, we shall remark only that, the proximity of the sun and moon seems to be the cause to which we must refer the extraordinary equinoctial tides, which happen most frequently; the one before the *vernal equinox*, and the other after the *autumnal*; that is, both of them at the time when the sun, passing through the meridional signs, is nearest us. But this does not happen every year, because there are sometimes variations produced by the situation of the orbit of the moon, and by the distance of the syzgies from the equinoxes. The great inequalities of the depth of the sea, the situation of the coasts, their declivity under water, sometimes rapid, sometimes otherwise; the different breadth of the channels and straits; and, lastly, the winds and currents; all these local, and sometimes accidental, circumstances alter the progress of the tides;—make them deviate from that regularity which they would have maintained in an open sea;—augment the impetus of the flow upon the coasts of confined channels;—and, by causing the degree of friction to which the waters are exposed to vary, shorten or prolong the relative duration of high and low water. Thus we see in the islands of the Pacific Ocean regular tides of only one or two feet elevation, whilst upon the western coasts of Europe, and upon the eastern coasts of Asia, the tides are extremely strong, and subject to many variations.

If it be objected to this theory of lunar attraction that there are gulfs as well as inland seas in which there are no tides, we may answer that these phenomena are additional proofs in favour of the hypothesis against which they are brought. In small collections of water the moon acts at the same time upon every part; it diminishes the gravity of the whole mass. But there is little or no surrounding water which can come and accumulate with the body thus attracted and elevated; for this swelling owes its origin less to a vertical or perpendicular motion of the attracting waters than to the lateral flowing in of the neighbouring waters, in consequence of their superior gravity. This is the reason why the Mediterranean has very small tides only.

TIDE-TABLE.

THE following Table, which exhibits the Times of High Water, with the mean Vertical Rise of Spring-Tides on the different Coasts of the Atlantic, will show, more clearly than any other argument, the nature of the Tides on the Ocean. A few explanatory remarks, which may be found practically useful, are annexed to each division.

BRITISH COASTS.	TIME.		RISE.	REMARKS.
	h.	m.	Feet.	
London	2	45	18½	It is a well-known fact, that, on all Coasts where tides prevail, the stream of flood continues to run, in the offing, some time after it is high water on the shore; and the stream of ebb, in like manner, after low water on shore.
Woolwich	2	15	18	
Nore	12	30	14	
Margate Roads	11	40	16	
North Foreland	11	15	17	
Ramsgate	11	20	21	
Deal	11	15	19	
Dover	10	50	20	
Folkstone	10	45	20	
Dungeness, on the West	10	30	24	
Beachy Head	10	16	18	The length of time between the changes of the tide on the shore and the stream in the offing, is in proportion to the strength of the current and the distance from the land; that is, the stronger the current, and the greater distance that current is from the land, the longer it will run after the change on the shore.
The Park and Selsea	11	0	15	
Portsmouth Harbour	11	40	16	
Cowes	11	15	15	
Needles	8	56	9	
Weymouth and Portland Road ..	6	40	7	
Lyme Regis	6	30	13	
Exmouth Bar	6	20	14	
Torbay and Dartmouth	6	0	16	
Plymouth Sound, Hamoaze, &c. ..	6	5	16	
Fowey	5	30	16	The time which the flood-stream runs in the middle of the English channel, after the time of high water on shore, is, westward of the meridian of Portland, about three hours; but, to the eastward, off Beachy Head, only one hour and three-quarters. In the offing, between the meridians of Dungeness and Folkstone, the North Sea and Channel-tides seem to meet; and the ebb of the one, uniting with the flood of the other, set in an easterly direction, off the French coast, more than four hours after high water on the western shore of Dungeness. But, for the particulars of this, and of the various inflections, &c. of the tide in the Channel, see the Book of Sailing Directions, in which they are minutely described.
Falmouth	5	15	18	
Lizard Point	4	55	18	
Mounts Bay	4	40	20	
Longships, &c.	4	30	20	
St. Mary's, Scilly	4	30	18	
St. Ives, Cornwall	4	30	22	
Padstow	5	0	24	
Lundy Island	5	30	30	
Minehead	6	0	36	
Kingroad, near Bristol	6	45	46	During the flood, the stream of the LAND'S END, where it divides, sets from the southward to the northward nearly 9 hours; and, within Scilly, it generally continues so to run about 8 hours. The ebb, therefore, here runs to the southward only 3 or 4 hours; a circumstance which should be particularly attended to.
<i>(In Nov. 1813, by actual measurement, the tide rose 50 ft.—A.L.)</i>				
Milford Haven	6	0	36	
IRELAND.				
Dublin Bay	9	45	12	
Saltee Islands	5	50	12	
Hook-Point, Waterford	5	0	12	
Cork and Kinsale. (In the Har- bours)	4	30	15	
Castlehaven, Baltimore, & Cape Clear	4	0	12	
Bantry Bay, Kenmare River, Dingle Bay, and Mouth of the Shannon	3	45	12	
Limerick	6	0	16	

COAST of FRANCE, in the CHAN-	TIME.		RISE.	REMARKS.
NEL.	h.	m.	Feet.	
Dunkirk to Calais.....	11	45	.. 19	In the great bight on the West of Cape La Hague, the flood-stream, being directly opposed by the coast, and pent up by the islands of Guernsey, Jersey, &c., accumulates to the height shown in the Table: and it thus forms the stream between Cape La Hague and the Isle of Alderney, called the Race of Alderney, which sets with the velocity of seven miles an hour. The tide hence, round Cape Barfleur, runs with rapidity: and the sea appears violently agitated about that Cape.
Ambleteuse.....	11	0	.. 19	
Boulogne	10	40	.. 19	
Etaples	10	35	.. 19	
St. Vallery sur Somme.....	10	30	.. 19	
Dieppe.....	10	25	.. 19	
St. Vallery en Caux.....	10	15	.. 19	
Fecamp	10	0	.. 19	
Le Havre de Grace.....	9	0	.. 20	
Honfleur	9	30	.. 19	
Caen and Dive	10	0	.. 19	
Isles of St. Marcou.....	9	15	.. 21½	
Fort La Hogue, &c	8	0	.. 21	
Cherbourg and Cape La Hague.	7	45	.. 21	
Guernsey and Alderney	6	0	.. 35	
Jersey and St. Malo	6	0	.. 45	
Mount St. Michael.....	6	30	.. 54	
Treguier	5	30	.. 32	
Le Sept Isles.....	5	0	.. 30	
Morlaix and Isle de Bas.....	5	15	.. 27	
Porsal	5	0	.. 20	
Passage du Four.....	4	0	.. 19	
Ushant.....	3	45	.. 21	
The Bay of BISCAY, and thence to GIBRALTAR and MALAGA.				
Roads of Bertaume, St. Mathieu, and Conquet	3	0	.. 21	On the Coasts of the Bay, at sea, it flows generally at three hours, and the vertical rise is from 19 to 15 feet, as shown in the Table.
Bay of Brest	3	50	.. 21	
Brest Harbour.....	3	45	.. 21	
Road of Dovarnenez.....	3	15	.. 21	
Bec du Raz.....	3	12	.. 21	
Port l'Orient	3	30	.. 20	
Blavet or Port Louis.....	4	0	.. 19	
Mouth of the Loire.....	3	45	.. 19	
Isle of Oleron, and Entrance of the R. Charente.....	3	45	.. 19	
Basque Roads	3	40	.. 20	
Rochefort	4	15	.. 21	[For a description of Quiberon Bay, the Road of Basque, Bayonne, and the Coast of Spain, &c., see Section III. hereafter: or, more particularly the new Book of Directions for the Bay of Biscay, &c., lately published by Mr. Laurie.]
Entrance of the Garonne or Gironde, and Bassin de Arcasson	3	45	.. 16	
Bayonne.....	3	15	.. 16	
Northern Coast of Spain, from St. Jean de Luz to Cape Finisterre	3	0	.. 16	
All the Ports and Harbours of the same Coast, including Ferrol, Betanzas, &c.....	3	45	.. 15	
On the Coast between Cape Finisterre and Cape St. Mary, and at the Entrance of the Rivers, generally about	3	0	.. 13	
In the Ports and Harbours of the same, generally.....	3	45	.. —	
Lisbon	4	0	.. —	
Setubal	4	30	.. —	
Lagos, in the River	2	0	.. 13	
Cape St. Vincent and Faro....	2	15	.. —	In the middle of the Strait of Gibraltar, the current mostly and generally sets to the east: but, on each side, the flood-tide sets to the westward. On the European side, west of the Isle of Tarifa, it is high water at 11 h., but the stream without continues to run until 2h. On the opposite shore of Africa, it is high water at 10 h., and the stream without continues to run until one o'clock: after which periods it changes on either side, and runs eastward with the general cur-

<i>The Bay of Biscay, and thence to GIBRALTAR, &c. CONTINUED.</i>	TIME.		RISE.	REMARKS.
	h.	m.		
On the Coast from Cape St.				
Mary to the Strait of Gibraltar	2	0	.. 10	rent. Near the shores are many changes, counter-currents, and whirlpools, caused by and varying with the winds, as shown under the head of <i>Currents</i> hereafter.
Tavira, Ayamonte and Lepe....	1	30	.. —	
Guelba and Palos	12	40	.. —	
San Lucar	1	45	.. —	
Bay of Cadiz (Inner part).....	1	45	.. 9	
Puntal of Cadiz	2	15	.. —	
Tarifa Island	12	0	.. 8	Near Malaga the stream runs along shore about eight hours each way. The flood sets to the westward.
Gibraltar	12	15	.. —	
Malaga	12	0	.. 3	

COASTS OF AFRICA.

Along the Coast of Marocco, from the Strait of Gibraltar to Cape Cantin.....	1	30	9 to 10	The currents on the African coast (hereafter explained,) render the given times of high water rather uncertain. Between Cape Cantin and Cape Blanco they are strong, and set as shown on the Chart.
Mogodor	4	0	.. 10	
Cape Geer	2	15	.. 10	
Cape Boiador or Bojador....	12	0	.. —	
Cape Blanco	9	45	.. —	
Bar of the Senegal	10	30	.. —	
Cape Verde	7	45	.. 3	
Goeree	7	48	.. 4	
Cape St. Mary	10	30	.. 3	
Within the River Gambia ..	11	15	.. 6	
Ilhas dos Idolhos, or Isles de Los, (<i>Flood to the N.</i>)....	9	0	.. 12	In the road without the Senegal, the current sets chiefly to the S.W. From the bar, strong freshes come down after the rains, and a powerful current of fresh water sets from the river to some distance out to sea.
River Sierra Leon	8	15	8 to 10	
Bananas Isles	8	15	8 to 10	
Along the Coast of Guinea, at sea, generally, the vertical rise is about $3\frac{1}{2}$ feet; and in the mouths of rivers, 5, 6, and 7, feet.				
Cape Coast.....	3	30	6 to 7	In the Bay of Yoff, to the N.E. of Cape Verde, the currents set rapidly; and sometimes in dangerous whirls.
Lagos	4	0	.. 6	
River Benin	6	0	.. 6	
Mouth of New Calabar River	6	0	.. 6	
Entrance of Cameroon River	6	0	6 to 8	
River Gabon or Gaboon....	6	0	.. 8	

THE ATLANTIC ISLANDS.

Azores.—Ponta Delgada, St.				These may be considered as a general mean; but the rise and time vary according to the winds, &c. On the south side of St. Michael's the tide is regular, and the flood sets to the eastward. In the offing it continues 3 hours later than on shore. At the Bermudas the tides vary in different parts of the islands. Common tides rise only 4 feet.
Michael's	12	30	.. 7	
Angra, Terceira	11	45	.. 6	
Fayal	11	30	.. $4\frac{1}{2}$	
Madeira.—Funchal	12	4	.. 8	
Canaries, in general. About	3	0	8 to 10	
Cape Verde Isles.—St. Nicolas	7	0	.. 6	
Port Praya	6	0	.. 4	
English Road, Bonavista	7	30	.. 5	
Bermudas.—St. George's	7	0 to 8	0 5 or 6	

NEWFOUNDLAND, &c.

Coast of Labrador and Strait of Belle Isle, generally....	11	30	.. 7	On all the coasts of Newfoundland the tides are very irregular; being greatly influenced by the prevailing wind.
Bay of Shecatia	11	0	.. —	

NEWFOUNDLAND, &c. CONTINUED.	TIME.	RISE.	REMARKS.
	h. m.	Feet.	
New and Old Ferolle.....	11 45	.. —	At the entrance of St. John's they set in a bore.
Bays of St. Genevieve and St. Barbe.....	11 30	.. —	
Isle Verte or Green Island ...	9 0	.. —	Between Cape La Hune and Cape Ray the flood sets to the westward in the offing, very irregularly, but generally 2 or 3 hours after high-water on shore. See, more particularly, the New Book of Directions for Newfoundland, &c. published by Mr. Laurie.
Bay of Pistolet	6 45	.. 5	
St. John's	6 30	.. 7	
Placentia Harbour	9 15	.. 8	
St. Pierre and Miquelon.....	9 0	6 & 7	
Between Cape Chapeaurouge and Cape Ray, generally...	9 0	7 & 8	
Beyond Cape Ray, northward, the tide is inconsiderable.			

RIVER of ST. LAWRENCE.

Quebec	6 0	.. —
Crane Island	5 0	.. —
Piliers or Pillars	4 45	.. —
Kamourasca Isles	4 0	.. —
The Traverse	4 30	.. 18
The Brandy-pots	3 30	.. —
Green Island.....	3 0	.. 16
Isle Bic	2 0	.. —
Matane	12 15	.. —
Cape Chat	12 0	.. 13

North Coast of the River.

Point Mille Vaches	2 0	.. —
Bersiamities Point.....	1 30	.. —
Manicouagan Bay.....	1 0	.. 12
St. Nicolas Harbour	12 0	.. 12
Point Deamon or Monts Pelees	12 0	.. 12
Seven Islands Harbour	1 30	.. 18

GULF of ST. LAWRENCE.

Mingan Harbour	8 0	.. 11
Gaspe Bay.....	3 0	.. —
Ristigouche Harbour	3 0	.. 7
Cocagne to Cape Tormentin, and thence to Pictou Harbour ...	7 0	.. 6
Gut of Canso	8 0	.. 8
Pr. Edwd. Isle. Charlotte Town	10 30	.. 6

BRETON ISLAND, NOVA SCOTIA, &c.

Port Hood	9 0	.. 6
Sidney Harbour	9 0	.. 6
Louisbourg	7 15	.. 5½
South shore of Madame I.	8 0	.. 8
Ship Harbour, in Gut of Canso	8 0	.. 8½
Chedabucto Bay	8 30	.. 8
Sable Island. North Side	10 30	.. 7
South Side.....	8 30	.. 8
Canso Harbour.....	8 45	.. 7
Torbay.....	8 45	.. 8
Country Harbour to White Island Bay	9 0	.. 8
Beaver Harbour	8 45	.. 7

From Green Island to Quebec the tides rise irregularly, but very considerably. From Coudre to Quebec the water falls 4 feet before the tide makes down. At the Isle of Coudre, in spring-tides, the ebb runs at the rate of 2 knots. The next strongest ebb is between Apple and Basque Isles; the ebb of the River Saguenay uniting here, it runs full 7 knots in Spring-tides; yet, although the ebb is so strong, the flood is scarcely perceptible; and below the Isle of Bic, there is no appearance of a flood-tide.

On the South side of PRINCE EDWARD ISLE, the tides are regular, but they are very irregular on the north.

The tide of the Gut of Canso generally sets in from the southward, but is very irregular, being influenced by the winds. After strong N.W. winds, the water in the Gulf of St. Lawrence is rendered low, which causes the stream to run northward, through the Gut, at the rate of 4 or 5 miles; the contrary happens with southerly winds. [For the Tides and Currents about Sable Island, see the description in Note 1, Page 31.]

Off Cape Sable the tide runs at the rate of 3, and sometimes 4, miles an hour; and in the Bay of Fundy, the tides are very rapid.

Cape D'Or and Cape Chignecto are high lands, with very steep cliffs, and deep water close under them. The same kind of shore continues to the head of Chignecto Bay, where very extensive flats of mud and quicksands

GULF of ST. LAWRENCE, CONTINUED.	TIME.		RISE.	REMARKS.	
	h.	m.	Feet.		
Spry Harbour	8	30	7½	are left to dry at low water. Here the tides come in a bore, rushing in with great rapidity: they are known to flow at the equinoxes from 60 to 70 feet perpendicular; and it is remarkable that, at the same time, they rise in the Bay Verte, on the northern side of the isthmus, only 8 feet.	
Halifax to St. Margaret's Bay..	8	0	8		
Mahone Bay to Liverpool Har- bour	8	0	8		
Shelburne Harbour	8	30	8		
Cape Sable	8	0	9		
Cape St. Mary	9	0	14		
Bay of St. Mary	9	30	16		
Gut of Annapolis. Entrance ..	10	0	28		
Cape D'Or. Entrance of Mines Channel	11	0	41		
Basin of Mines, viz.					In the Harbour of St. John, the tide of flood is weak, but the ebb runs very rapidly.
Windsor	12	0	36		
Seven Isles Harbour	11	0	31	At MOUNT DESERT ROCK, the stream of flood divides to run eastward and westward. With the Skuttock Hills about N.N.E., and within 4 or 5 leagues of those of Mount Desert, the flood-stream sets E.N.E. and the ebb W.S.W.; but, at the distance of 9 or 10 leagues from the land, the current, in general, sets to the S.W. and more westward. From the Mount Desert Rock, to the Fox Islands, at the entrance of the Bay of Penobscot, the flood-stream sets W.S.W. along shore; but it, nevertheless, runs up to the northward into Isle Haute Bay, &c.	
Cape Split	11	15	40		
Apple River. Chignecto Bay..	11	0	32		
Cumberland Basin. Fort	12	0	60		
Shepody Bay	11	30	48		
St. John's, New Brunswick	12	0	25		
UNITED STATES.					At SANDY HOOK the stream of tide continues to set in, at the rate of two knots, until nearly 9 hours.
Passamaquoddy and Moose Is- land	11	30	25		
Machias	11	0	12		The tides in the rivers of the CHESAPEAKE are varied by the winds. When it blows 2 or 3 days at N. or N.W. the flood does not rise more than 2 feet; but, when it blows a gale from S.E. or E.S.E., it rises 4 or 5 feet. The Times of high water in the Chesapeake have been given as follow: Lynhaven Bay, or South side, 10 h.: East shore, within Cape Charles, 12 h.: Mouth of the Rappahanock, 3 h.; of the Patomac 3½ h.; of the Patapsco, or Baltimore River, 7½ h.
Mount Desert and Goldsborough	11	0	12		
Penobscot River and Fox Isles	10	45	9		
Townsend, Broad Bay, and George's River	10	45	9		
Kennebec and Sheepscut	10	45	9		
Portland and Casco Bay	10	45	9		
Newbury Port and Portsmouth	11	15	10		
Marble-Head, Salem, and Cape Anne	11	30	12		
Boston Lighthouse	11	30	12		
Plymouth, Cape Cod, and Mono- moy Point	11	30	6		
Race Point	10	45	—	In the vicinity of Charleston and Savanna, N.E., Easterly, and S.E. winds cause higher tides than the other winds, and, also, vary their course. At about 6 leagues from the land, off Port Royal, in 12 fathoms water,	
Nantucket Shoals	10	45	—		
Nantucket Harbour	12	3	6		
Tarpaulin Cove. Elizabeth Isles	9	52	5		
Gay Head; New Bedford, Block Island, and Rhode Island, Har- bours	7	37	5		
Off Newhaven	9	0	8		
New London, New York, and Elizabeth Town Point	8	54	6		
Sandy Hook. New York	7	30	6		
Cape May	8	30	6		
Cape Henry	10	0	4½		
Hampton Road	10	30	—		
Charleston. South Carolina ..	7	0	6		
Port Royal	8	15	6		
St. Simon's Sound	9	0	6		
St. Simon's Bar	7	30	6		
St. Simon's Offing	6	45	—		

	TIME.	RISE.	REMARKS.
	h. m.	Feet.	
UNITED STATES, &c. CONTINUED.			
St. Mary's Bar	8 15 ..	7	the flood sets strongly to the southward, and the ebb northward. At a great distance from shore no tide is perceptible.
Nassau Bar	7 30 ..	7	
Bar of St. Augustin	7 30 ..	6	
Hillsborough Inlet	7 30 ..	5	
Nassau, New Providence	8 30 ..	4	Although, at the BAHAMAS, the rise and fall is considerable, the tide of flood sets an indraught on the northern part of the Little Bahama Bank; from every point of the compass, which renders an approach very dangerous.
Florida Kays. Sombrero Kay..	8 0 ..	5	
Dry Tortugas	8 30 ..	3	
Chatham Bay to Cape Roman.			
(Very irregular)	— — ..	2	
Mouths of the Missisipi. Ditto	— — ..	1½	

The tide sets with some force directly on and off the western side of the Grand Bank of Bahama; particularly at the full and change of the moon. High water at 7h. 30m: or thereabout. Rise 3 to 4 feet. On the Middle Ground of this Bank the Tides set in every direction.

In Providence N.W. channel, the current runs, generally, to the eastward, about two miles an hour.

Near Egg Island, to the N.W. of Eleuthera, it is, however, uncertain, and great attention should be paid to the lead. In the passage within Egg Island, the tide runs at the rate of four miles, and rises above four feet: the flood setting eastward, and strongly over the reefs.

About the Berry Islands and Providence, the water rises two feet higher when the sun comes to the northward of the line, than it does when the sun is to the southward, and its strength is in a similar proportion. Here and at the Bemini Isles the flood sets to the N.E.

Near Cayo Hueso, or *Thompson's Island*, on the Florida Reef, the tides are, in some measure, regular within the reef; the flood setting to the westward, and the ebb contrary. To the westward, between the Tortugas and Cayo Marques, the flood sets variably through to the northward, and ebbs to the E.S.E.

It is remarkable that, on the south side of these Kays, the flood comes from the S.E. ward; but, on the north side of them, all the way from Cayo Hueso, the flood runs to the eastward, along the edge of the bank, and to the southward, through the little channels, in order to fill up the intermediate bays and lagoons, with the assistance of the flood from the southward.

Westward of Cayo Hueso there is a general current to the S.W. ward, along the reef, and to some distance to the south side of it.

In Ponce or Chatham Bay it runs tide and half-tide; viz. 3 hours flood, then 3 hours ebb: next 9 hours flood, &c. Here, in some places, it is a mere fall; but in some of the channels it is as much as four men can do to stem the current with a boat.

During a S.E. gale or storm, the water in the bays and rivers of West Florida has been known to rise 7 feet perpendicular, and vessels of burthen have been driven in, among the pine-trees, at some distance from shore.

From Cape Roman, northward and westward, the tide seems to ebb and flow only once in the 24 hours; but it is irregular, and much governed by the winds. Yet the effects in a dry season are very perceptible in the rivers at a distance from the sea.

MEXICAN SEA AND WEST-INDIES.

Vera Cruz. (Only 1 tide in 24 hours)	Irregular	— — ..	2	Near the Shoals and Reefs of Anton Lizardo, between Alvarado and Vera-Cruz, the currents are often dangerous, and appear to be almost entirely influenced by the winds. The pilots say
Cape Antonio, Cuba. (Irreg.)	9 30 ..	1½		
Cartagena	2 0 ..	1		
Port Royal, Jamaica. (Uncer.)	— — ..	1		

MEXICAN SEA AND WEST-INDIES, CONTINUED.	TIME.		RISE.		REMARKS.
	h.	m.	Feet.		
Hayti. Cape Haytien	6	0	..	2½	that a change of wind hereabout produces an alteration in the current within six hours.
Port Rico. St. Juan	8	20	..	1½	
St. Bartholomew's. (Irreg.) ..	—	—	..	1	Among the West-Indian Islands the tides are, generally, so inconsiderable as not to require notice; but, on the coast of Guyana, they set with some degree of force; and, off this coast, a strong current commonly sets to the N.W. at the rate of 2 to 3 miles an hour.
Guadaloupe and Martinique.					
(Irregular.)	6	45	..	1½	
Barbadoes (Scarcely perceptible) —	—	—	..	1	
Tobago. (Uncertain.)	—	—	..	3½	
Trinidad. Port Spain	4	30	..	6	
Demerary. Entr. of River	4	30	..	9	
Berbice	—	—	11 or 12		
Surinam. Bram's Point	4	30	..	7	
Cayenne	3	45	..	6	

About the Island of St. Bartholomew, the flood, at new and full moon, runs S.E., and it is then high water at 10h. 30m. *p.m.*, while the sun is farthest to the North of the Equator; but comes about two hours sooner in the following months, till the sun gets farthest to the south, when it is high water at 10h. 30m. *a.m.*; and it runs afterwards in the same proportion back again. The winds, which are of long continuance, sometimes make a trifling difference. The horizon is also lowest at the time when the sun is farthest to the north of the line; and so to the contrary. The greatest difference in the ebbing and flowing is 18 inches; but, in general, only 10 inches.

About Virgin-gorda and the passages of the Virgin Islands, the current runs regularly, setting eastward during the moon's passage from the horizon to her zenith, and from her setting till she arrives at nadir, and to the westward while the moon passes from zenith to the horizon, and from nadir till her rising. The rate varies according to the breadth of the channels, from 2 to 5½ knots, and the rise is from 20 to 40 inches.

3. OF THE CURRENTS.

A CURRENT is at present to be understood as that *atmospherical* motion of the water, which has been already noticed. In other words, as a stream on, or a particular set in the direction of, the surface of the sea, occasioned by winds and other impulses, exclusive of (but which *may be influenced by*) the causes of the tides. It is an observation of *Dampier*, that CURRENTS are scarcely ever felt but at sea, and TIDES but upon the coasts; and it is certainly an established fact that currents prevail mostly in those parts where the tides are weak and scarcely perceptible; or, where the sea, apparently little influenced by the causes of the tides, is disposed to a quiescent state. This will be obvious by an attentive consideration of the following descriptions. The necessity of attention to the silent, imperceptible, and therefore dangerous, operation of currents, will be equally apparent.

The currents of the Atlantic are all of a local, and mostly of a temporary, nature; yet experience has shown where and how they predominate; and reason will inform the mariner where he is to expect and allow for their operation.

Of these currents, the first in order, from the Land's End of England, is RENNELL'S CURRENT, a temporary but extensive stream, which occasionally sets from the Bay of Biscay to the westward and N.W., athwart the entrance of the English Channel, and to the westward of Cape Clear.

Second.—The POLAR or GREENLAND CURRENT; with EASTERLY CURRENTS to the Coasts of Europe and Africa, and Southerly to the Coast of Guinea.

Third.—The AFRICAN CURRENT, an easterly stream along the coast of Africa, into the Gulf of Guinea, with a westerly outset from the same.

Fourth.—CENTRAL CURRENTS, between the Azores and Bermudas, &c. to the W.S.W.

Fifth.—The EQUATORIAL CURRENT, a vast stream setting to the W.N.W. from the Equator to the Island of Trinidad and Caribbean Sea.

Sixth.—The CURRENTS of the CARIBBEAN SEA, and MEXICAN STREAM, an inset into the Mexican Sea, from the south-eastward.

Seventh.—The FLORIDA or GULF-STREAM, an outset from the Mexican Sea, setting thence to the northeastward, through the Strait of Florida, and thence eastward towards the Newfoundland Bank and Azores.

Eighth.—The ST. LAWRENCE STREAM, setting from the River and Gulf of that name around Breton Island, to the southward, and south-west.

In explaining this subject, we shall endeavour, in the first place, to establish the facts which prove the existence of these currents, and then attempt to deduce the causes, according to the given descriptions.

1. OF RENNELL'S CURRENT; OR THE CURRENT ATHWART THE ENTRANCE OF THE ENGLISH CHANNEL.

This current, which is occasionally of considerable breadth and strength, frequently sets athwart the entrance of the Channel to the N.W. and W.N.W. at some distance to the westward of the isles of Ushant and Scilly. As it apparently depends on temporary circumstances, it is only a temporary stream; and, although a certain quantity of northerly indraught is always to be allowed for, with the tide of flood, on approaching the Scilly Islands, the current, unless with particular winds on the ocean, will be scarcely, if at all, perceptible.

The general causes of currents, so far as they depend upon the set of the winds, &c., are generally known to seamen; and, that, a long continued wind, in one particular direction, will either produce a stream, where no obstruction exists, or cause an accumulation of the water against an opposing coast, until a reverberation takes place, needs no demonstration. The latter appears to be the case in the present instance. A long and continual prevalence of westerly and south-westerly winds, in combination with a current, that commonly sets into the southern part of the Bay of Biscay, occasions an accumulation of water in the Bay, which seeks an escape, by setting to the N.W. or W.N.W. within the limits described by the half-arrows in the accompanying Chart.

That such a current does actually prevail, is too well known to be longer doubted. Mr. KELLY, the author of a Treatise on Navigation, published near a century ago, has given a particular instance of it: by which he shews that a ship becalmed, with her sails furled for 48 hours, was in that time carried by the current 46 miles to the northward;* and we have many subsequent examples of vessels which have been set, by the course of the stream, to the northward, or upon the rocks, of Scilly. But the writer to whom we are more particularly indebted for an elucidation of the subject, is the ingenious and learned JAMES RENNELL,† Esq. F.R.S. who has given an illustration of it, which places it beyond all controversy; and from whose paper, published in the *Philosophical Transactions* of the year 1793, we abstract the following observations:—

“In crossing the eastern part of the Atlantic, the Hector, East-India ship, Captain Williams, in 1778, encountered, between the parallels of 42 and 49, very strong westerly gales; but particularly between the 16th and 24th of January; when, at intervals, it blew with uncommon violence. It varied two or more points, both to the north and south-west, but blew longest from the northern point; and extended, as subsequently appeared, from the coast of Nova Scotia to that of Spain.

“Within sixty or seventy leagues of the meridian of Scilly, on the 30th of January, between the parallels of 49 and 50, the effect of the current was first experienced, which set the ship to the north of her intended parallel, by nearly half a degree, in the interval between two observations of latitude; namely, in two days. The wind, ever afterwards, prevented the ship from regaining the parallel; for although the northern set was trifling, from the 31st until she arrived near Scilly; yet the wind being scant and light, never enabled her to overcome the tendency of the current. It is also to be

* Had observations for the longitude been made, it is probable that the current would have been found, also, to have set westward. See, farther, hereafter.

† From the name of this gentleman, the current is now generally denominated RENNELL'S CURRENT.

observed, that the direction of the current was much more westerly than northerly: the ship crossed it on so very oblique a course as to be in it a long time, and was driven, as it appears, nearly 30 leagues to the west by it: having soundings in 73 fathoms, in the latitude of Scilly, and afterwards ran 150 miles by the log, directly east, before she reached the length of the islands; running, in effect, 120 miles, and shallowed the water only nine fathoms.

"The current was not only sensible by the observations of latitude, but by rippings on the surface of the water, and by the direction of the lead-line. In consequence of all, the ship was driven to the north of Scilly, and barely able to lay a course through the passage between those islands and the Land's End.

"There being no time-keeper on board, the longitude was uncertain; but it was concluded, that the current, at times, extends to 60 leagues west of Scilly, and runs close to the west of the islands. The breadth of the stream, where the Hector crossed over it, was supposed to be about 30 leagues.

"A journal of the Atlas, East-India ship, Captain Cooper, furnishes much clearer proofs, both of the existence of the current, and the rate of its motion. This ship, outward bound, in January, 1787, had advanced 55 leagues to the westward of Ushant, when violent gales began at south, and for four days continued between that point and W. by S.; during which time the ship was lying-to, with her head to N.W. On the fifth day, the wind abated, but was S.W.; stormy weather then ensued for nine days: the wind blowing from all points between South and S.S.W., but chiefly, and most violently, from W.S.W. and S.W.; and, when the ship then proceeded southward on her voyage, she was, by the reckoning, only $2\frac{1}{2}$ degrees of longitude West of Cape Finisterre; but, by time-keepers, more than *four degrees and a half*.

"On the day the gales commenced, the reckoning was within 14 minutes of that by the time-keepers; the latter being more westerly, owing to the current. On the third day after, the difference was but 24 minutes, when the ship was 25 leagues, S.W. from Scilly, in soundings of 70 fathoms. The ship, in longitude $8^{\circ} 28'$, had entered into the stream; and, its course being opposite to that of the Hector, it facilitated her progress, and carried her clear of the S.W. Coast of Ireland.

"After this, in the course of 51 hours, the ship had set two whole degrees to the westward of her reckoning: and, in the 45 hours following, she had a farther set of 23 minutes; so that, in 4 days only, she had been carried by the current no less than 2 degrees and 23 minutes; and, since the gale began, $2^{\circ} 32'$ of longitude, or 93 nautic miles.

"It consequently appears, that the Atlas experienced a westerly current, from about 24 leagues W.S.W. of Scilly, to near four degrees of longitude west of the meridian of Cape Clear, where its effect was imperceptible. It may, therefore, be inferred, that the stream goes off to the N.W. in the parallel of 51° : between longitude 14 and 15° , and the S.W. coast of Ireland.*

"No northern set is indicated in the journal of the Atlas. This would have been remarkable, had the weather permitted nice attention to the reckoning; but, it is to be remarked that, observations on the latitude were not regularly made; and besides, that the great distance of 36 miles was allowed for only 20 hours drift to the N.W., when the ship was lying-to.

"From the nature of this current, it must be obvious, that its velocity will always be proportionate with the strength and direction of the wind, by which its direction will also be regulated; and, that the middle of the stream will preserve its original course in a greater degree than its borders. The direction of this appears to be N.W. by W.;

* Captain J. W. Montearth, in the ship Fame, Sept. 1817, in lat. 51° , long. 20° to 13° , experienced a current (which he allowed for and found correct) setting from W.N.W. to N.W., at the rate of from half to three quarters of a mile an hour. The first part of this course, it may be observed, was on the parallel traversed by the Atlas, and commenced more than four degrees to the westward of the true course of that ship.

Add to this, that, after a long prevalence of westerly winds across the Atlantic, and in running for Cape Clear, from lat. 50° , and long. 17° , when nearly on the parallel of the Cape, Lieut. Chas. Hare, in the ship Waterloo, 11th Sept., 1821, found, by chronometer, &c., that a current had set the ship 54 miles W. by N. in the 24 hours, preceding the noon of that day.—EDITOR.

the eastern border more north ; and the western more west ; so that the northern current is stronger close to the west of Scilly than more to the westward.

“ From the foregoing observations may be induced the following inferences :—

“ 1st. That ships, which cross the current obliquely, steering a true E. by S. course, or more southerly, will continue longer in it, and be more affected by it, than those which steer more directly across it. In crossing it with light winds, the effect will be the same. Allowance should also be made for the more northerly direction of the eastern edge of the current.

“ 2d. That, after a continuance of westerly gales, even should a good observation of latitude be made, it would be imprudent to run eastward, from the Atlantic, during a long night. For a ship might remain in the current so long as to be drifted from a parallel, deemed a very safe one, to that of the rocks of Scilly. It is therefore recommended, that vessels, at such times, should keep, at the highest, in $48^{\circ} 45'$, because in $49^{\circ} 30'$ the whole effect of the current may be experienced in the worst situation. But, from the current in $48^{\circ} 45'$, a southerly wind will set the ship into the Channel. In time of peace, coming from the Atlantic, it would be still better to make Ushant.

“ 3d. That ships, bound to the westward, from the channel, with a south-westerly wind, so that it may appear indifferent which tack they go on, should prefer the *larboard* tack, as they will then have the benefit of the current.”

In a SUPPLEMENTARY PAPER on the EFFECTS of WESTERLY WINDS in RAISING the LEVEL of the ENGLISH CHANNEL, dated 22d of June, 1809, Major Rennell has stated,

“ In the “ *Observations on a Current that often prevails to the Westward of Scilly,*” which I had the honour to lay before the Royal Society many years ago, I slightly mentioned, as connected with the same subject, the effect of strong westerly winds, in raising the level of the British Channel ; and the escape of the superincumbent waters, through the Strait of Dover, into the then lower level of the North Sea.

The recent loss of the *Britannia*, East-India ship, Captain Birch, on the Goodwin Sands, has impressed this fact more strongly on my mind ; as I have no doubt that her loss was occasioned by a current, produced by the running off of the accumulated waters ; a violent gale from the westward then prevailing. The circumstances under which she was lost, were generally these :

In January last she sailed from her anchorage between Dover and the South Foreland, (on her way to Portsmouth,) and was soon after assailed by a violent gale between the west and south-west. The thick weather preventing a view of the *lights*, the pilot was left entirely to the reckoning and the lead ; and, when it was concluded that the ship was quite clear of the Goodwin, she struck on the north-eastern extremity of the southernmost of those sands. And this difference between the reckoning (after due allowance being made for the tides) and the actual position, I conclude was owing to the northerly stream of current, which caught the ship, when she drifted to the back, or eastern side, of the Goodwin.

The fact of the high level of the Channel, during strong winds, between the W. and S.W., cannot be doubted : because the increased height of the tides in the southern ports, at such times, is obvious to every discerning eye. Indeed, the form of the upper part of the Channel, in particular, is such as to receive and retain, for a time, the principal part of the water forced in, as may be seen by the Chart ; and, as a part of this water is continually escaping by the Strait of Dover, it will produce a current ; which must greatly disturb the reckonings of such ships as navigate the Strait, when thick weather prevents the land, or the lights of the Forelands and the North Goodwin, from being seen.

I observe, in a new publication of Messrs. Laurie and Whittle, entitled “ *Sailing Directions, &c. for the British Channel,*” that, throughout the Channel, it is admitted, by the experienced persons whom they quote, that strong S.W. winds “ cause the flood-tide to run an hour, or more, longer than at common times :” or, in other words, that a current overcomes the ebb-tide a full hour ; not to mention how much it may accelerate the one, and retard the other, during the remainder of the time.*

* It is also asserted, that, in the mouth of the Channel, the extraordinary rise of tide, in stormy weather, is ten feet ; that is, at common springs twenty, and in storms thirty, feet.

It is evident, that, the direction of the current under consideration will be influenced by the form and position of the opposite shores, at the entrance of the Strait; and, as these are materially different, so must the direction of the stream be within the influence of each side, respectively. For instance, on the English side, the current having taken the direction of the shore between *Dungeness* and the *South Foreland*, will set generally to the north-east, through *that* side of the Strait. (See the Chart.) But, on the French side, circumstances must be very different; for the shore of *Boulogne*, trending almost due north, will give the current a like direction, since it cannot turn sharp round the point of *Grinez*, to the north-eastward; but must preserve a great proportion of its northerly course, until it mixes with the waters of the North-Sea. And it may be remarked, that, the *Britannia*, when driven to the eastward of the Goodwin, would fall into this very line of current.

There is another circumstance to be taken into the account, which is, that the *shore of Boulogne*, presenting a direct obstacle to the water impelled by the westerly winds, will occasion a higher level of the sea there than elsewhere; and, of course, a stronger line of the current towards the Goodwin. (See the Chart.)

It must, therefore, be inferred, that, a ship passing the Strait of Dover, at the back of the Goodwin Sands, during the prevalence of strong W. or S.W. winds, will be carried many miles to the northward of her reckoning; and, if compelled to depend on it, may be subject to great hazard, from the Goodwin.

It will be understood, of course, that, although the stream of current, alone, has been considered here, (in order to simplify the subject,) yet that, in the application of these remarks, the regular tides must also be taken into the account. But, from my ignorance of their detail, I can say no more than that I conceive that the great body of the tide from the Channel must be subject to much the same laws as the current itself. The opposite tide will doubtless occasion various inflections of the current, as it blends itself with it; or may absolutely suspend it: and the subject can never be perfectly understood, without a particular attention to the velocity and direction of the tides in moderate weather, to serve as a ground-work.*

FURTHER OBSERVATIONS ON RENNELL'S CURRENT.

Since the publication of the first paper on the current of the Channel, and the supplementary paper immediately preceding, Major Rennell has published some farther important observations upon it, which were read before the Royal Society, April 13, 1815, and from which we have the following extracts:

“During the interval of twenty-one years, since the Society did me the honour to receive my Observations on the Current to the Westward of Scilly, more facts, relating to that current, have been collected; as well as observations on its effects, in different parts of its course, between Cape Finisterre and Scilly; the whole tending to a confirmation of the general system set forth, in 1793; and, in one instance, affording, perhaps, a clearer proof of the strength of the stream, in respect of its *northerly* direction, than any of those adduced on the former occasion.

“In pursuing the detail of these facts and observations, I shall begin in the neighbourhood of Cape Finisterre, and proceed with the course of the current, along the Bay of Biscay; and thence, across the mouth of the British Channel, to Scilly, and the entrance of St. George's Channel.

“The first three facts regard the current from the open sea, setting into the south side of the Bay of Biscay, and along the north coast of Spain; which current has been supposed, in the former Paper, to be occasioned by the prevalent westerly winds; which force the water near the shore, *into the Bay*, and along the southern coast of it. The water so displaced, would be followed, of course, by the adjacent water *behind* it, in the open sea; and so on, successively, to a certain extent. This cause must surely be referred to, as the origin of the Scilly current.

* Messrs. Laurie and Whittle's publication allows the tides in this quarter a velocity of one mile and a half per hour, at the springs; half a mile at the neaps. The *Britannia's* accident happened at *dead neaps*.

" I. The first case is that of the Earl Cornwallis East-India ship. The circumstance occurred on her outward passage: she was well provided with time-keepers, as most of the India ships are.

" On the 12th of March, 1791, between the parallels of 43° and 44° , and at $3^{\circ} 45'$ of longitude, west of Cape Finisterre, (about 53 leagues,) this ship experienced an easterly current, equal to 26 marine miles. Her position being directly opposite to the line of the southern coast of the Bay of Biscay, it is a fair conclusion that, the current was occasioned by the cause above-mentioned; or, as seamen call it, the *indraught* of the Bay; which, it appears, extends to, at least, 53 leagues from the shore. And as the rate, in this place, exceeds one mile per hour, it may be supposed, that the effect extends to a still greater distance.

" It may here be remarked, that the same ship, in coming out of the *Chops* of the Channel, a few days before, was *set* 24 miles to the westward, 15 to the northward, in the course of the 24 hours; that is, 28 miles, in a direction of N.W. by W. This may be supposed to be the same stream of current in its course from the Bay towards Scilly.

" II. The second fact, is that of the *drift of a bottle*, which was thrown out of a Danish ship, (I believe, sent on discovery,) since the publication of the former Paper.

" The bottle was thrown out, in lat. $44\frac{1}{2}^{\circ}$, long. 12° west from Greenwich; that is, about 48 miles to the N.E. of the Cornwallis's station, at the time that she began to feel the current, on the 11th of March. It was taken up by a sentinel on duty, near Cape Ortegal, and, as was supposed, at the moment of its driving into the surf. If this was really the fact, the bottle, according to the date of the letter contained in it, must have been carried, at the rate of half a mile per hour, in the direction of about E. by S. $\frac{1}{2}$ S.; the distance was about 64 leagues.

" The report of this circumstance was transmitted by the French consul at Corunna, to the Academy of Sciences at Paris.

" It may be observed, that the drift of the bottle was much to the *south* of east; whereas, that of the Cornwallis was east; that is, both pointed towards Cape Ortegal, or its vicinity; as if the main stream of the current was concentrated there.*

" With respect to the velocity of the current, in the present case, all, of course, depends on the time of the arrival of the bottle at the shore. It might have been thrown up long before it was seen, and washed off again, by the tide, or surge of the sea. The *direction*, the most important point, cannot be questioned.

" III. The third fact is very simple, and perfectly conclusive. Off Cape Ortegal, at a considerable offing, Admiral Knight found the current, at the rate of one mile per hour, setting to the E.S.E.; that is, nearly *along-shore*.

" The reader will immediately perceive that these three facts converge, as it were, to one point; that is, in the proof that the waters of the Atlantic flow into the Bay of Biscay, along the north coast of Spain.

" It would seem that the north-westerly current, by Scilly, did not, at least in many cases, balance the easterly current round Cape Ortegal and the land of Finisterre.† The loss of His Majesty's frigate Apollo, with most of her convoy, may surely be attributed to the operation of this current. Captain (afterwards Commissioner) Wallis assured me, that, after having made, as he supposed, ample allowance for clearing Finisterre, yet, in the night, he had a very narrow escape from shipwreck. Very many others have been brought into the same kind of danger: so that the land of Finisterre, were it not discernible at a considerable distance, and its offing clear of rocks and shallows, and, moreover, situated in a finer climate, would prove a kind of Scilly to mariners.

" I have not been able to obtain any proofs, on record, concerning the course of the current *round* the Bay of Biscay. I formerly collected some information from

* It is observed that, in the mouth of the Strait of Gibraltar, between Cape St. Vincent and Cape Cantin, the currents point in all directions, between S.E. and N.E. towards the entrance of the Strait, which may be considered as the pipe of a funnel.

† Nor, admitting an equal rate, in both places, could it well be. For the current enters the Bay of Biscay in an *east* direction, but goes off from it *north-west*. So that, if a ship was carried fifty miles to the N.W. from Ushant, she would only have made about thirty-five westing; but, in the other case, she would be carried the *whole* fifty eastward, towards the Bay and Cape Finisterre.

a French commander respecting it. He said, that the setting of the current along the coast of France, to the north and north-west, was a fact well understood; and even acted on by many, in the choice of the *tack*, on which the current gave the greatest advantage, with dead winds.

"One circumstance, and that a very striking one, in respect of this particular, is, that the soundings in the Bay of Biscay show little or no *muddy bottom*, to the southward of the *Garonne* river; but every where to the northward. This seems to show that the mud of the *Garonne*, *Charente*, *Loire*, &c. &c. is all carried to the northward; and by what cause, but a northerly current? Had the motion of the sea been variable, the mud would surely have been distributed to the south, as well as the north, of the mouth of the *Garonne*. The alluvial *embouchures* of the rivers in general, here, and the positions of the banks formed by them, in the sea, point to the N. or N.W.; apparently the effect of the same sea-current.*

"IV. In continuation of this current along the Bay of Biscay, I shall next mention, that Captain (afterwards Admiral) JOHN PAYNE assured me, that, being in His Majesty's ship *Russell*, in a severe gale of wind at S.W., and with the ledge of rocks called the *Saintes* not far to leeward, he was under apprehensions for the safety of the ship during a whole night, but, to his surprise, found himself carried clear of the danger by a current; which set the ship, in all, about 70 miles to the north-west.

"V. The flowing of the tides, on the west of Scilly, cannot well be accounted for, on any other supposition, than that the flood is prolonged by a southerly current. The flood-tide is known to run nine hours to the northward; but the ebb, in the opposite direction, only three hours. This particular had not come to my knowledge, when the Paper of 1793 was written.

"VI. But the most satisfactory proof, not only of the *existence* of a northerly current, athwart the mouths of the British and Irish channels, but also of its *velocity*, (at least during certain intervals,) is a statement in a book published in 1733, entitled JOSHUA KELLY's *Treatise of Navigation* (in two volumes octavo.) This case is the more satisfactory, as it happened in a *dead calm* of forty-eight hours continuance: so that all uncertainty, regarding the accuracy of a *sea-reckoning*, allowances for *leeway*, *drift*, &c., is precluded; since the changes of position that took place could only have been effected by the motion of the sea, either in the nature of a *current* or of a *tide*; and this latter must be placed out of the question, since the interval of time included no less a space than that in which four *fluxes*, and as many *refluxes*, have their periods: so that they may well be supposed to balance each other.

"'It has been observed,' says MR. KELLY,† 'by an experienced commander, who used the West-India voyages for many years, from England, (in his return from one of these,) that, in about the latitude of $48^{\circ} 30'$, open with our British Channel, having a good observation (of latitude) at the same time, it proving calm and smooth water, inasmuch that he handed his sails, and so lay forty-eight hours. The first twenty-four hours, at noon, he observed the latitude again, with clear weather, and found by the same that he had *drove to the northward twenty miles*; which made him distrust his former observation, though his mate agreed with him; because the ship had not gone, to his knowledge, one mile; and, upon review, he found that he was not mistaken. The next twenty-four hours, being still calm, he had again another good observation; and then found himself about twenty-six miles to the northward of his last observation; which confirmed him that he was right the day before; and that this must be imputed to a strong northern indraught, or current, there. For when you come near the soundings, and till you bring Ushant south of you, on the E.S.E. course,‡ *you will hardly hold your*

* From a view of the Chart of soundings between Spain and Ireland, one might be led to suppose, that the deep water and steep shore along the north coast of Spain had been *partly* occasioned by the water driven in from the Atlantic, in westerly storms, along that coast; and which had gradually worn away the matter *there*, and deposited it on the bank which extends from Bayonne to the westward of Ireland. For the bank seems to expand, as it goes northward, in like manner as the current: and the water is shallower than might be expected, in proportion to the depths farther in.

† Volume the first, page 434.

‡ These are *compass* bearings. The magnetic variation, at that time, being about a point and a half westerly, these will be respectively E. $\frac{1}{2}$ S., N.E. $\frac{1}{2}$ E., and E.N.E. $\frac{1}{4}$ N., true.

latitude ; and the general course is E.N.E. or E. by N. ; if but a small matter to the southward of latitude 49° . And he says, that would have been my course, if we had not met this opportunity of discovering this strong indraught : and, for want of observation, [i. e. if he had not known the latitude,] must have run up St. George's Channel, or the North Channel, as many have, and still do, from want of the same [information.]

“ After his last observation, the wind sprang up ; and, making allowance for the said indraught, [i. e. in his future course,] the next day he was brought into soundings ; and the following day he was brought in sight of the *Lizard*, by steering to the southward of the east.*”

“ It will naturally occur to the reader, that, although this case gives the *northing only* ; yet that, in respect of the main question, which is, the danger of shipwreck on Scilly, or of being carried into the Bristol Channel, it is sufficient to produce a conviction of the necessity of attending closely to the ship's course, when on the point of entering the British Channel, after, or during, a course of strong westerly or south-west winds. But it would, doubtless, have been more satisfactory, had the *direction* of the stream been known. Had that been *north-westerly*, as I have before supposed, the rate of velocity must have been more than a mile and a quarter *per hour* ; or approaching to one and a half (the *northing* being twenty-three at a mean in the twenty-four hours :) whilst that in the *Atlas East-Indiaman*, recorded in a former Paper, was about one mile *per hour*, during four days, consecutively.

“ The statement in Mr. KELLY's book, which is indeed altogether more brief than could be wished, is also defective through the want of the distance sailed, from the place of the last observation for the latitude, to that from whence they saw the *Lizard Point*. They had their first soundings the day after that observation ; and on the following day they saw the *Lizard*. His course appears to have been regulated with a view of preserving, nearly, his parallel of $49^{\circ} 16'$; to which he had been carried by the current. It is not likely that he sounded to any great depth ; perhaps 70 fathoms ; which in that parallel might have been about 20 leagues south-west from Scilly : and it does not appear that he considered himself in soundings when the calm began ; which, however, it is probable he was, although in deep water.† Accordingly one may conceive that his position, *at the end of the calm*, might have been about the meridian of Cape Clear, or somewhat to the eastward of it. It must be recollected, that, in running towards the Channel, after the calm, he had still to encounter the same adverse current ; and that, possibly, to within 30 or 40 miles of his seeing the *Lizard*.

“ But whether his position, during the time that he was under the influence of the current, be a degree more or less to the eastward, the fact bears the same on the main question ; since a ship, in crossing the stream, wheresoever it may be situated, must have been carried out of her reckoning, and thereby placed in danger ; in the event of thick weather happening subsequently, and preventing their setting themselves right by an observation of latitude.

“ His idea, of the eastern edge of the stream, is worth remarking ; as it approaches, in a general view, to the truth. It was, that in *about* the parallel of 49° , it approached to the meridian of Ushant. And with respect to the *direction* of the stream, as he calls it a *northern indraught*, he certainly concluded that it ran to the northward, into the St. George's or Irish Channel, brushing the west side of Ushant and the Land's End. And the effect of the current on his ship was, no doubt, such as to warrant that belief, with those whose knowledge of the subject was confined to the mere effect of setting them to the northward of Scilly and into the mouth of the Bristol Channel.

“ The information contained in this statement does not even terminate in the mere facts of the existence and force of the current. The commander of the West-India ship is said to have made *many voyages* to and from that quarter ; and his narrative shows him to have been an *observant man*. Yet he was ignorant of the existence of such a current, until the case occurred which has been just stated. This then alone may serve to show, very satisfactorily, that the current does not exist in strength, but at certain intervals ; and therefore operates in a more dangerous, because a treacherous, manner.

* Meaning, no doubt, the E.S.E. course, by compass, as above, or true E. $\frac{1}{2}$ S.

† Perhaps 30 or 35 leagues to the west of *Ushant*, and in about 100 fathoms.

"Had it constantly prevailed, like that round the Cape of Good Hope, &c., it could not have escaped detection; and, in consequence, few or no evils would have ensued: but these effects being only felt casually, they were considered as mere contingencies, arising from wind and weather, as in other parts of the sea; and not as resulting from a fixed cause, always operating, although in very different degrees; since no person at that time had collected the different cases, with a view to examine and to compare them. Some, indeed, referred it to the indraught of the Bristol Channel; without considering that, if such a power existed at all, it was difficult to conceive how it could be suspended, and why it should not operate at all times.

"Our navigators, in earlier times, appear to have entered the British Channel on a more southerly parallel than they have done in latter times. For, although they might have been ignorant of the real cause of the disturbance in their course, yet many of them believed that there was an *indraught*, as they called it, into the St. George's Channel; so that one effect of the current, that is, the *northern set*, had not passed unobserved, although the *cause* was not understood; nor, of course, could it be known when to expect it. But I have also heard it remarked by sea-officers, as long ago as I can remember, that 'it was unaccountable what should occasion their *running down so much distance*, in coming in with the land from the westward.' I never heard, however, that there was any suspicion of a current setting westward.

"The idea of a northern *indraught* into St. George's Channel (but which applies equally to the current west of Scilly) is clearly set forth, in a publication by Captain Joseph Mead, in 1757; but which came to my knowledge only very lately. Captain Mead first relates the case of the ship *Hope*, of Liverpool, bound from the coast of Guinea to that port, in November, 1735. (Preface, page iii.)

"Having had a good observation, by which they found they had the Irish Channel open, the wind continued to blow strong from between the south and west, but mostly from the former. Having no other observation [of latitude] for six days, in which time they carried sail constantly, they by reckoning expected to fall in with Cape Clear: but in the following night they fell in with the *Blasquets*.' These islands and rocks are situated in lat. $52^{\circ} 10'$, or about 48 miles to the north, and one degree of longitude to the westward, of Cape Clear.

"Again (page 10) he says, that the Bristol merchant-ships, which fall in with Cape Clear, on their homeward passage [from the West-Indies, &c.], shape their course from thence, with a large wind, to the high land near *Padstow*; which is the land they choose to make to lead them to the entrance of the Bristol Channel. That, in estimating this course, they allowed four or five degrees in the bearing, to compensate for the indraught into St. George's Channel. This angle would give about 13 or 14 nautic miles; and is probably what they found by experience to be the general amount of the *northern set*.*

"He goes on to say that, in like manner, the safety of ships, after they come into soundings, till they reach Scilly, depended on their making *no less allowance* than the Bristol men do in the other channel. For, says he, 'experience informs me that, from the commencement of soundings, in lat. $49^{\circ} 30'$ N. to the length of Scilly, in *fair weather*, I had found the northern indraught to be six or eight miles in the twenty-four hours.'"

Here, then, the fact of the *northern set* is a second time recognized; though without any suspicion, any more than before, of there being a *westerly set* also.

Here it may be proper to state, what appears to me to be a very important fact; although perhaps not connected with the current in question, but materially affecting the safety of the navigation between the British Channel and Dublin. It was communicated to the author by Captain Evans, a gentleman who superintends the harbour-works at Holyhead, and who has had much experience in the navigation of the Irish Sea.

"All navigators, (says he,) in their voyage from the Land's End to Dublin, find themselves more or less carried to the eastward, whilst running up St. George's Channel;

* Although they might not have known at that day the *true* latitude of Cape Clear, yet it may reasonably be supposed that they knew the quantity of the *difference of latitude* between Cape Clear and the high land of Padstow; as it was so necessary to their purposes, and so easy to be obtained.

which is the cause of so many vessels finding themselves in Cardigan Bay; where, in tempestuous weather, and westerly winds, many have been lost. And this he justly supposes to be occasioned by a current setting to the north-eastward."*

OTHER EXPERIMENTS ON RENNEL'S CURRENT, &c.

1. FROM CHANNEL SOUNDINGS TO THE WEST OF SCOTLAND.—A bottle thrown from the ship Duke of Marlborough, Captain Jeffery, by Mr. George Thom, near the Sole Bank, in latitude $48^{\circ} 38'$, longitude 9° W. Found on the shore of Carsaig, near the middle of the south side of the island Mull, 14th of April, 1821, and made known by Mr. Hector Maclean. At the time this bottle was thrown into the sea, the ship was on its passage to London from the Cape of Good-Hope, and an allowance was made for current to the N.W. of 12 miles to the 24 hours. From the spot in which it was dropped, it seems unquestionable that the bottle was carried by the current to the west and north of Ireland, and thence between Ila and Mull, to the place in which it was found. It has, therefore, well answered Mr. Thom's purpose "*of confirming Rennell's Current.*"

2. ST. GEORGE'S CHANNEL.—A bottle from the ship Osprey, of Glasgow, Alexander M'Gill, master, which sailed from Greenock, on the 20th of February, 1820, on a trading voyage around the world. This bottle (No. 310) was thrown into the sea 1st of March, 1822, on the ship's return from Calcutta, in latitude $49^{\circ} 54'$ N., and longitude $12^{\circ} 20'$ W.; it was found on the shore, upon the south side of Milford Haven, on the 6th of the following month, April; and the notice was thence transmitted to the Admiralty.

3. ATLANTIC TO BRISTOL CHANNEL.—A bottle from the brig Albert, R. L. Robertson, master, latitude $47^{\circ} 20'$ N., longitude 22° W., 24th of January, 1822, on the passage from Virginia to England, the wind then about W.N.W., and had so prevailed for two or three days. Found in Rockam Bay, about 4 miles west from Ilfracombe 29th of July, 1822, and attested by the agents to Lloyd's.

4. BAY OF BISCAY, NORTH SIDE.—A bottle from H. M. ship Graham Moore, 6th of July, 1821, in latitude $47^{\circ} 47'$ N., longitude $7^{\circ} 51'$ W. Found, 15th of September, 1821, on the coast of St. Jean de Mont, arrondissement of Sables d'Olonne, department of La Vendée; and made known by the '*Journal de Paris.*' This bottle was impelled in an E.S.E. direction, the north-westerly current not then prevailing, and was within the influence of the tide.

5. By Captain Livingston's Journal, 28th November, 1820, "It appears that in 24 hours, ending at noon of yesterday, (on the passage from Gibraltar,) we made about 15 minutes North by current; and in 24 hours ending at noon this day about 13 North, and in the two days rather more than $20'$ E. Therefore about N. $40\frac{1}{2}'$ E. 37 miles in the 48 hours.

6. BAY OF BISCAY, SOUTH SIDE.—A bottle from the schooner Morning Star, of Liverpool, Captain Andrew Livingston, 7th of October, 1821, lat. $42^{\circ} 45' 39''$ N., long. $13^{\circ} 3' 21''$ W. Found about 29 miles to the northward of Bayonne, in the arrondissement de Dux, latitude $43^{\circ} 58'$ N., longitude $1^{\circ} 20'$ W., and made known by the direc-

* We have assumed the liberty of giving a very long extract, with regard to the current, as it sets athwart the Channel; but it is requisite to notice that, the venerable author, after establishing this fact, has given some farther remarks on the currents, in general, about the British Isles; all of which, it is almost superfluous to state, are worthy of the mariner's attention. See Philosophical Transactions of the year 1815, if the whole of the "Observations," &c. (published by Mr. Nicol,) should not be obtainable separately.

From subsequent communications, it appears that, the water sets into the Bay of Biscay from the N.W. as well as the West, at times as high as the parallel of 47° ; and it is supposed that a whirl is sometimes formed by the outer part of the water, that the Bay discharges to the N.W., turning to the West, and round to the South and S.E., while the inner part shoots to the N.W. and W.N.W. Hence it may be concluded that, when the volume of water received, and, of course, the velocity, is very great, the whirl to the left or West is farther removed to the N.W., and the contrary.

Of this current Captain Livingston says, "I have seen, in a late Magazine, some one alleging that Rennell's Current, athwart the Channel, is imaginary. I know the contrary, from experience, and perfectly remember, that, in 1813, while master of the Lark sloop, I was set one day 24 minutes North of dead-reckoning, equal to one mile an hour, but can say nothing as to the westing. On coming lately from Bordeaux, 1819, we were set by it 17 minutes North in 24 hours; but, as a passenger, I had, at this time, no opportunity of keeping a reckoning."

tion of the Minister of the Marine and Colonies of France, in the '*Moniteur*' of January 24, 1822. To his Excellency, and the Baron Seguier, Consul-general of France in England, we are indebted for this information, and for the original document, addressed, by our friend, to the editor of this work.

2. *The POLAR or GREENLAND CURRENT, with EASTERLY CURRENTS to the Coasts of EUROPE and AFRICA, and Southerly to the Coast of Guinea.*

BOTH the great easterly and westerly motions of the waters of the Atlantic may be traced to very remote causes. The *Equatorial Currents*, as hereafter shown, may be clearly traced from the Indian Ocean, and around the Cape of Good Hope, to the Brazilian Sea. Those of the *northern regions*, may, in like manner, be traced from the Polar Seas, Hudson's Bay, and Davis's Strait. The latter, in their progress, on the west, winding about the coast of Newfoundland; and, towards the East, setting eastward and E.S.E., to the Bay of Biscay; more to the southward along the coast of Portugal, and more to the northward, towards and along the Western Isles of Scotland, &c. In the Summer, more constantly in these directions; in the Winter, more variable and less southerly.

This scheme of a *general* predominance in the motion of the waters is grounded, not upon any questionable theory, but upon incontrovertible facts. The evidence of a powerful southerly current between Iceland and Greenland is shown in our '*Memoir, &c. on the Northern Ocean*,' pages 56 and 112: the currents from Hudson's and Davis's Straits are also described in the same work, page 61.

For the origin of the Currents which fall into Baffin's Bay and Davis's Strait, Captain Dundas Cochrane adverts to the Polar Sea, which washes the northern coasts of North-America. "Every expedition," says he, "which has been sent from this country up Baffin's Bay, Davis's Strait, Hudson's Bay, as also that under Captain Franklin, has noticed the perpetual currents setting from the Polar Basin into Baffin's Bay; Captains Ross and Parry found them upon the first, as did the latter on his last two, voyages, at the rate of three and four miles an hour. I believe that there can be but little doubt that, from Hudson's Bay to Lancaster's Sound, there is an endless variety of channels and straits which must form currents; and the more numerous and contracted those channels are, the greater the difficulty of stemming them. It is, indeed, miraculous how the ships have been so often saved from being dashed to pieces, crushed to atoms, or run down by icebergs, from thus sailing in opposition to the stream.

"Upon the other [the western] side of America we have the voyages of Cook, (or more properly of Clerke) of Kotzebue; and, lastly, of the Russian expedition under Captain Vasilieff. Currents were found by these three navigators setting to the North, N.E. and E.N.E. The voyage of the latter is, however, more in point: the commander of that expedition told me, at Kamtchatka, that so strong was the E.N.E. current, after his fast-sailing sloop had got round [beyond] Icy Cape thirty miles, he was afraid to continue lest he should not be able to get back; considering, as Captain Vasilieff did, that it would be imprudent, if not dangerous, to winter upon the north coast of America, separated from his consort; the latter being employed in surveying the N.E. coast of Asia, &c.

"All authors, all judges, all persons who have made enquiries upon the subject, admit of a current setting from the Pacific into the Polar Sea, (towards Autumn at least) by way of Behring's Strait, as well as a current from the Polar Sea to the Atlantic Ocean by way of Baffin's Bay.

"The Currents observed by Captain Franklin, and strengthened by the drift wood being *always* to the westward of the headlands, prove, beyond a doubt, that, in these regions, no western current ever takes place."*

These remarks satisfactorily illustrate the cause of the current which so powerfully sets to the southward from Hudson's Strait, &c. thence to the Strait of Belle-Isle and Coast of Newfoundland. On the eastern coast of the latter, spreading over the ocean, it appears to come from the northeastward: sometimes with a velocity of two miles an hour. Its strength, however, varies with the direction and force of the wind. Passing

* Arguments in favor of an Expedition, for exploring the North Coast, commencing with Behring's Strait, by Capt. John Dundas Cochrane, R.N. *New Monthly Magazine*, 1st May, 1824.

down the eastern coast of Newfoundland, it turns round Cape Race, and sets thence along the south coast of the island, until it meets with the St. Lawrence current, a little to the westward of Miquelon Island, as shown hereafter.

From the mouth of DAVIS'S STRAIT on the East, it has become clear, from various experiments, that the predominating currents set to the eastward. Of the bottles thrown into the sea from the ships commanded by Captains Ross and Parry, in 1818, one was found, dated 24th May, on the Isle Bartragh, Killala Bay, Ireland; another, dated 29th May, about three miles from Innisowen Head, near Urris, on the west of Ireland; another, dated 3d of June, was found at Balnarrald, North-Uist, one of the Western Isles of Scotland. The times in which these were found were June, July, and August, 1819; it is impossible to describe the course of these bottles, or how they were impelled by the winds; and such facts are recorded merely from the want of better data.

What may be the *general* direction of the predominating current from and about the North Cape of Europe we cannot say; but we are certain that, it is very common for ships from England, outer bound, to be far astern of the reckoning; and that, in proceeding towards the White Sea, in the spring, they meet with great drifts of ice from that sea, as shown in our '*Memoir, &c. on the Northern Ocean.*' Immense ice-bergs were seen off the coast of Denmark, in January, 1820, supposed to be fragments of larger masses, rent from the North.

Other experiments on these currents have been made as follow :

1. ICELAND TO THE FRITH OF CLYDE.—A bottle from the Merioneth, whale-fisher, R. Morris, master, 27th July, 1820, in latitude $62^{\circ} 10'$ and longitude $19^{\circ} 30'$. Found on the 4th September, 1820, by John Lamont, a fisherman of Bute, near the Cumrays. In the month of August, therefore, this bottle was carried by the current, in a South-easterly direction, to the North Channel of the Irish Sea; and thence, by the tide of flood, to the entrance of the Clyde.

2. GREENLAND TO TENERIFE.—A bottle from the ship Hecla, Captain Parry, 16th of June, 1819, in latitude $58^{\circ} 13' N.$, longitude $46^{\circ} 55' W.$,—found on the S.E. shore of Tenerife, 29th of July, 1821, and the notice was transmitted to England by Messrs. Pasley, Little, and Co.

3. HUDSON'S STRAIT TO IRELAND.—A bottle from H.M. ship Fury, Captain Parry, July, 1821, in latitude $62^{\circ} 8' N.$, and longitude $62^{\circ} 27' W.$ Found 9th of March, 1822, on the shore of Iris, county of Donegal, Ireland, latitude $55^{\circ} 15'$, longitude $7^{\circ} 28'$; and thence transmitted to the Admiralty.

4. EASTERLY CURRENT TOWARDS SCOTLAND.—A bottle from the Sandwich, of Dartmouth, Walter Squire, master, bound from Liverpool to Labrador, lying-to in a gale, 1st of June, 1821, in latitude $50^{\circ} 16' N.$, longitude $36^{\circ} 25' W.$ Found 2d December, 1821, on the western shore of South-Uist, in the southern range of the Hebudes or Western Islands.

5. EASTERLY CURRENT TOWARDS SHETLAND.—A bottle from the snow Romulus, Captain John Crawford, 27th of July, 1819, in latitude $57^{\circ} 47' N.$, longitude $20^{\circ} 42' W.$ Found on a beach called the Croe Air, upon the N.W. part of the Main Land of Shetland, by Charles Man, 14th of November, 1819, and made public by Mr. Gilbert Man.

6. NORTH OF SCOTLAND TO NORWAY.—A sealed bottle from the ship Hecla, dated 22d May, 1819, lat. $59^{\circ} 4'$, long. $6^{\circ} 55' W.$ —found 21st Sept. near the mouth of a river above Rød-ø, lat. $60^{\circ} 45'$, long. $4^{\circ} 54' E.$

7. BETWEEN NEWFOUNDLAND and the ENGLISH CHANNEL.—A bottle from the Royal Union, from Quebec to Dublin, Dan. Grant, master, 27th Sep. 1822, dropped in lat. $48^{\circ} 15' N.$ long. $45^{\circ} 10' W.$ was picked up at Scilly, 11th Dec. 1822, and transmitted to Lloyd's.

8. BETWEEN NEWFOUNDLAND and the ENGLISH CHANNEL.—A bottle from the James Cropper, Capt. Marshall, from Liverpool to New York, 10th Jan., 1824, in lat. $48^{\circ} 20'$, long. $38^{\circ} 5'$; found 12th Feb., 1825, at Gunwallow fishing-cove, in Mount's Bay.

9. TOWARDS the BAY OF BISCAY.—The ship *Carshalton Park*, Captain J. Steele Park, on returning from Jamaica to London, in July, 1824, in latitude 48° , and longitude 13° got into a stream setting to the southward, and which thence operated so strongly against the ship, that some difficulty was found in getting sufficiently far to the northward for a good Channel track. The wind shifted suddenly from S.W. to North; the vessel immediately hauled up E. by S.; and, although the weather was fine, and the water quite smooth, she made no better than a true E. by N. course.

Captain Park says, "the moon happened to be near the full about this time; and I had opportunities for ascertaining the latitude by her meridian altitude three or four nights in succession before we made the land: therefore I could not be mistaken as to the strength and direction of this current; for the interval between the observations of sun and moon was only 10 or 11 hours; and the greatest attention was paid to the steerage.*

10. ST. GEORGE'S CHANNEL to CAPE ST. VINCENT.—On the 14th of August, 1823, Capt. *Livingston*, in the sloop *Favorite*, on his passage from Liverpool to Gibraltar, took his departure from the *Smalls Lighthouse*, and thence he regularly made observations on the Current, &c., so far as adverse weather permitted. On the 23d he had arrived on the parallel of $46^{\circ} 23'$; previously to which the course seems to have been materially affected by the *tide*, but here the differences amounted to $51' 55''$ southerly, and only $4' 39''$ N. From lat. $46^{\circ} 23'$, August 23d, to lat. $36^{\circ} 52'$ Aug. 31. the current invariably predominated to the southward, and between these parallels amounted to eighty-nine miles, in the eight days.

At 4 h. 53 m. of Aug. 31, with Cape St. Vincent bearing true North, an excellent meridian altitude of the planet Saturn gave lat. $36^{\circ} 54' 8''$. The total southing to this point gave $2^{\circ} 18'$, and the difference of longitude between dead-reckoning and that by landfall gave $1^{\circ} 42' 7''$ of easting.

In the brig *Friends*, of Glasgow, 24th Aug. 1820, Capt. *Livingston* states, "The current set us round Cape St. Vincent without our having seen the cape, though we steered courses for the purpose of seeing it, and we were looking out for it when I got a lunar, and ascertained that we were then past it. Immediately after this the sea became smooth, being broken off by the cape."

BETWEEN CAPE FINISTERRE and the AZORES, the general drift, or tendency of the surface of the sea, appears to be to the south-eastward; varying, however, to the East and West, and even to the northward, as the winds operate, either one way or the other, more especially during winter, as already noticed.

In the brig *Ward*, from New Brunswick, September, 1823, with westerly winds, which had prevailed for 14 days, between lat. $45^{\circ} 20'$ and $43^{\circ} 40'$, long. $22^{\circ} 30'$ to 16° , Lieut. Charles Hare, the commander, found the current setting E.S.E. at a mile and a half in the hour.

Capt. W. J. Capes, on his passage in the *Lady Macworth* from England to the West-Indies, in August and Sept. 1823, found the currents as follow: taking the ship's position at noon:—

Aug. 27	Lat. $43^{\circ} 38'$	Long. $12^{\circ} 40'$	Current easterly.
28	.. 43 43	 12 17,	{ By good chronometric observation, the current had set 30 miles to the eastward.
29	.. 42 41	 12 28,	{ Current 10 miles E.S.E.
30	.. 41 42	 12 28,	{ Current 25' easting and 11' southing, by good observation.
31	.. 40 3	 13 23,	{ Current 9' to the S. and 14' to the E.
Sept. 1	.. 38 5	 14 17,	{ No current perceptible in the 24 hours.
2	.. 35 59	 15 6,	{ Current 26 miles to the southward.
3	.. 34 8	 15 55,	{ Current southerly, 3 or 4 miles.
4	.. 33 1	 16 7,	{ Porto Santo, distant 4 or 5 leagues.
5	.. 32 22	 16 49,	
6	.. 31 16	 17 26,	{ Current 7 miles to the southward.
7	.. 29 28	 17 38,	{ Current 10 miles ditto.
8	.. 28 48	 17 26,	{ Current, 17' S. and 13' E.
9	.. 28 32	 17 17,	{ No observation on Current.
10	.. 28 9	 18 10,	
11	.. 27 4	 19 41,	{ Current, 16' to the southward
12	.. 25 45	 21 43,	{ Current, 15' to ditto.
13	.. 24 44	 23 52,	{ Current, 4' to the S. and 13' W.

* The same ship, on the 10th of July was on Channel soundings, the latitude by meridian altitude of the sun, $48^{\circ} 53'$: the longitude, by chronometer and lunar, $9^{\circ} 44'$ and $9^{\circ} 56'$ respectively. "Kept the ship E. $\frac{1}{2}$ S. and generally East till 11 h. 51 m. p. m., when, by the moon's meridian altitude, it was found that the latitude was $49^{\circ} 11'$. We had gone, during this interval of 11 h. 51 m.. 68 miles by the log, carefully attended to, in smooth water. Now, allowing $2\frac{1}{2}$ points of variation, we ought to have made 26 minutes of northing; whereas, in point of fact, we made 13 only."

Influenced, probably, by the Channel ebb, the current appeared also to have a tendency to the west.

In September and October, 1775, the officers of the Liverpool, ship of war, observed, that, in latitude $45^{\circ} 43'$, longitude $21^{\circ} 20'$, a current was found setting to the southward 12 to 15 miles per day, which continued until they made the island of Corvo, the longitude of which, by lunars, agreed within 12 miles of the longitude by account.

Again, on the 18th of October, in latitude $42^{\circ} 4'$, and the Isle of Corvo bearing about S. 75° E. 154 leagues, the sea being very smooth, it was suddenly agitated into a short irregular sea, (without any shift or increase of wind,) such as is generally occasioned by currents, and the next day it was found that the ship was 30 miles to the southward of the reckoning. This current (*blending with the Gulf Stream,*) continued until the 22d of October, having then arrived in latitude 37° , longitude $44^{\circ} 43'$ West of Greenwich, and its general rate appeared to be a mile and a half in the hour.*

The CURRENT along the COAST of PORTUGAL appears to set nearly in the direction of that coast. On the 25th of October, 1810, a gun-boat for the service of Cadiz, being in tow of the Rebuff gun-brig, broke adrift in a gale of wind, in latitude $39^{\circ} 44'$, and longitude $9^{\circ} 38'$ W. On the 19th of November following, his Majesty's sloop of war Columbine, when cruising 8 or 9 miles to the westward of Cadiz lighthouse, observed a gun-boat to leeward, which proved to be the identical boat that twenty-five days before had broken adrift from the Rebuff. The distance traversed by the boat was about 350 miles, or 14 miles a day, chiefly by the current, the wind in the mean time being so various as nearly to render the drift negative, or, if any thing, against the set of the current.†

On the currents setting towards the Bay of Biscay and the Strait of Gibraltar, Captain, since Admiral, Sir Erasmus Gower made observations in five passages to Madeira, from which he concluded the most general direction to be to the S.E., and the mean velocity about 11 miles in every 50 leagues.

Mr. Robert Bishop observed, by experiment, in the year 1761, a current setting on this part of the ocean, between S.E. and South. After making some necessary corrections, he considered the current as setting at the rate of 8 or 10 miles in 100, in a middle rate of sailing. Other experiments have likewise been made, which give nearly the same result; and the observations of Captain Wm. Bligh, of his Majesty's ship Director, outward-bound, in September and October, 1799, and made in this part of the Atlantic, are corroborative of the truth of these observations. They shew, that, although the currents in those months are very variable, but setting mostly in a southerly direction, yet that between South and S.E. predominates.

In proceeding to Tenerife, Sir Erasmus Gower observed a constant current setting to the southward, at the rate of a mile an hour; equal to 22 miles in the distance between Madeira and that island.

Captain Mackintosh, of the Hindostan, who had made twenty passages in this route, generally experienced a current from the 39th degree of latitude to that of the Canaries. In this part of the ocean he generally found, from repeated and accurate observations, that this current set to the E.S.E. He found it strongest opposite to the entrance into the Mediterranean or Strait of Gibraltar; and, in one voyage, the current was computed, by his time-keeper, to set about 40 miles per day. This current inclines more southerly, as it approaches the Canaries. It strikes on the coast of Morocco, and takes about Cape Boiador a different direction. Nearly in-shore, from an indefinite point, and part

* The effect of a current setting to the south-eastward, and the necessity of a competent knowledge of currents in general, cannot any way be more forcibly shown than by noticing the melancholy catastrophe of His Majesty's ship Apollo, Captain J. W. T. Dixon, and the merchant-ships under her convoy, on the 2d of April, 1804. The Apollo, with 69 ships, for the West-Indies, sailed from the Cove of Cork on the 26th March. With a fair wind, blowing strong, they steered about W.S.W. until the 31st, when the wind changed more to the westward. At noon, on the 1st April, latitude observed $40^{\circ} 51'$ N., longitude, by account, $12^{\circ} 29'$. At 8 p. m. the wind shifted to S.W., and increased to a gale, with a heavy sea. The convoy stood to the S.E., and, at half-past three next morning, struck on the Coast of Portugal, in about $40^{\circ} 22'$ N., 3 leagues to the northward of Cape Mondego. Captain Dixon, and about sixty men of the Apollo, perished, in their endeavours to reach the shore; the other part of the crew remained two days clinging to a fixed part of the wreck, without nourishment. About 40 sail of merchant-men were wrecked about the same time; some sunk with all their crews, and most of them lost several men. This lamentable event has been attributed to the want of chronometric observations, and the consequent ignorance of the set of the current, which must certainly have been very strong.

† This fact was, we believe, first given to the public in the Quarterly Review, January, 1816, page 377.

of the stream, sets northward towards the Strait of Gibraltar, and the other part sets to the southward.

At about 74 leagues W. $\frac{1}{2}$ S. from Cape Mondego, on the 9th June, 1799, M. de Humboldt, in the sloop Pizarro, was on his voyage towards the West-Indies; and, on this day, in latitude $39^{\circ} 50'$ and longitude $13^{\circ} 50'$, he says, that they began to feel the effects of the current setting towards the Strait of Gibraltar, &c. From the parallel of 37° to that of 30° , the vessel was sometimes carried, in twenty-four hours, from 18 to 26 miles to the eastward. The direction of the current was, at first, E. by S.; but nearer the Strait it became due East, and it assumed a more southerly direction on the passage towards Tenerife. "Several pilots, who frequent the Canary Islands, have found themselves on the Coast of Lanzarote, when they expected to make good their landing on Tenerife. M. de Bougainville, in his passage from Cape Finisterre to the Canary Islands, found himself in sight of Ferro, four degrees more to the eastward than his reckoning indicated.

In July, 1816, Captain And. Livingston, in a run of only nine days from Ireland, during which there was no opportunity for observations, was set upwards of three degrees to the eastward of his reckoning; having made the Salvages, when he expected to have been to the westward of Madeira.

The frigates *Sta Maria de la Cabeza* and *Lucia* sailed from Cadiz, 12th April, 1795, and on the 17th at 6 a.m. they made Point Naga, in Tenerife, when they found, by a comparison with their chronometers, that the current had carried them 62 minutes to the eastward.

Don Vincente Tofno had, ten years before, proceeded in the *Lucia*, from Cadiz for Mogodor; he sailed on the 27th of April, 1785, and, on the 1st of May, before mid-day, arrived at the last-named port. On the 5th he sailed from it, and on the morning of the 8th anchored again in Cadiz. On his voyage out, he found that the current, in 4 days, had set him $21\frac{1}{2}$ miles S. 18° E., and on his return S. 49° W. 39 miles. This variation of the current shows that the waters throughout all this extent do not always run to the S.E., but that they vary, with the line of coast, to the south-westward also.

The deceased Admiral Don Cosmè de Churruca sailed from Cadiz, on the 15th of June, 1792, for the purpose of surveying the West-Indian Islands and Spanish Main. He took his departure at half-past 3, p.m., in lat. $36^{\circ} 29' 25''$, and long. $0^{\circ} 6' 40''$ W. of Cadiz. In his Journal, he says, "It is well known among our seamen, that, in the bight of Cadiz (that is, the coast comprehended between Cape St. Mary and Cape Trafalgar) there is a current setting constantly to the eastward; but as, near the shore, the effect of the tide must necessarily be felt, it may also modify the direction of the current. When we established our point of departure, the strength of the ebb was already begun to decrease; but as, during the early part of the night, we were unable to get any considerable distance from the shore, we consequently felt all the force of the flood-tide setting to the northward; and this appears to have been the reason why we experienced a current to the N.E.: for the current, which always sets into the Strait of Gibraltar, combined with the flood-tide, ought nearly to give that N.E. direction. After our departure, and from mid-day of the 16th, we sailed with variable winds until the 21st, when the wind became fixed at N.N.E., and we found that, in the 24 hours, from the 21st to the 22d, the current had set S. 42° E. $9\frac{1}{2}$ miles; though in consequence of uncertainty in the dead-reckoning, and the variableness of the wind, it is possible the error was contracted without any current; the situation at mid-day of the 22d being in lat. $30^{\circ} 18' 51''$ N., and long. $8^{\circ} 59' 21''$ West of Cadiz.* The intention was to ascertain the position of the Salvages, which were seen the same evening, and he then makes the following reflections:—"The whole error of longitude by dead-reckoning, was $34' 6''$ E.; the sum of all the errors in latitude, after various compensations, was about $3' 45''$ to the North; therefore, the total error made during the voyage was $34' 6''$ to the eastward, and $3' 45''$ to the southward; and as if we had experienced a daily set of 4 miles S. $82^{\circ} 35'$ E. The Pilot's reckoning was kept by a log-line, marked to 48 English feet, for the 30s. glass, and was a-head of the vessel $57' 25''$ in longitude, and the sum of its errors in latitude was $8' 39''$ to the southward. According to this line, the vessel's total error was, about $47\frac{1}{2}$ miles, or 7 miles daily, N. $79^{\circ} 43'$ E. We see, therefore, that the knot of $50\frac{1}{2}$ English feet, indicated better the true course of the vessel until she

* From Greenwich, $15^{\circ} 16' 58''$, and about 40 miles to the eastward of the Salvages.—EDITOR.

made the Salvages, as situated by M. Verdun; and that, if it had any fault, it was that of giving too much distance and not too little, as is commonly believed. This experiment, though not however sufficient to decide in favour of marking the log-line to 50½ English feet, at least affords a presumptive proof in its favour, &c.*

Mr. James Grey Jackson, in his valuable Account of the Empire of Marocco,† has stated, that, the coast, between the latitudes of 20 and 32 degrees North, is a desert country, interspersed with immense hills of loose sand, which are, from time to time, driven by the wind into various forms, and so impregnate the air with sand, for many miles out to sea, as to give the atmosphere an appearance of hazy weather: navigators, not aware of this circumstance, never suspect, during such appearances, that they are near land, until they discover the breakers on the coast, which is, in some parts, so extremely flat, that a person may walk a mile into the sea without being over the knees; so that ships strike when at a considerable distance from the beach: added to this, there is a current, which sets in, from the west, towards Africa, with inconceivable force and rapidity; with which the navigator being generally unacquainted, he loses his reckoning, and, in the course of a night, perhaps, when he expects to clear the African coast, in his passage southward, he is alarmed with the appearance of shoal water; and, before he has time to recover himself, finds his ship aground, on a desert shore, where neither habitation or human being is visible. In this state his fears are soon increased by a persuasion that he must either perish in fighting a horde of wild Arabs, or submit to become their captive; for, soon after a ship strikes, some wandering Arabs, strolling from their duar in the desert, perceive the masts from the sand-hills; and, without coming to the shore, repair to their horde, perhaps 30 or 40 miles off, to apprise them of the wreck, when they immediately assemble, arming themselves with daggers, guns, and cudgels. Sometimes 2 or 3 days or more elapse before they make their appearance on the coast, where they await the usual alternative of the crew, either delivering themselves up, rather than perish with hunger, or throwing themselves into the sea.

But, to resume the description of the currents:—M. de FLEURIEU, in his admirable illustrations of the voyage of *Etienne Marchand*, around the world, has paid very particular attention to the set of the currents throughout the whole of the route, and his remarks corroborate very clearly the facts already described. In that work, M. Fleurieau states, that, in a run which he himself made, in 1768-9, in the *Isis* frigate, from Cadiz to Tenerife, by a direct course, and with a steady breeze from N.E. to E.N.E., he had an opportunity of ascertaining the constant effect of the current, which sets to the eastward so long as a ship sails in the tract of sea situated to the westward of the Strait of Gibraltar, and at a little distance from it. Clear weather permitted him, during the four days employed in this run, to take daily observations for determining the longitude of the ship, by the help of the time-keepers of *Ferdinand Berthoud*, of which the daily rate had been ascertained at Cadiz; and, in comparing, every day, the ship's progress towards the west, deduced from the observations, with that indicated by dead reckoning, there appeared the following results:—

On the first day, the current had set to the eastward $11\frac{1}{4}'$; on the second, $12\frac{3}{4}'$; on the third, $9\frac{1}{2}'$; on the fourth, $1'$; when the current ceased, in lat. 31° , to be perceptible.

Therefore, during the first three days, the movement impressed on the ship to the eastward, carried her towards that side $33\frac{1}{4}'$ or $27\frac{3}{4}'$ miles; and, by a mean, about 8 miles in 24 hours.

The quantities which the ship had been carried, in the same interval, towards the south or towards the north, had nearly counterbalanced each other: $8\frac{1}{2}'$ to the southward, $6\frac{1}{2}'$ to the northward. (*Voyage de l'Isis, en 1768 et 1769.*)

The ship of M. Marchand, named the *Solide*, left Cape Sparte, bearing South, on the 29th December, 1790, and made the Peak of Tenerife, bearing S. $6\frac{1}{2}'$ E., about 35 leagues distant, on the 5th of January, 1791. In this time it was found that a current had set the ship 39 miles E. 13° S., equal to a mean drift of 5.8 miles per day of 24 hours.

* Farther remarks on Currents, upon the same voyages, are given hereafter.

† London, quarto, 1809. See, also, the affecting Narrative of the Shipwreck and Captivity of M. de Brissou, in 1787; and that of Robert Adams, wrecked in the American ship *Charles*, John Horton, master, 1810. The latter is noticed more particularly, with others, in the description of the coasts of Africa hereafter.

From the 5th to the 9th of January, inclusive, when the ship, on the latter day, was in lat. $21^{\circ} 24'$, long. $19^{\circ} 26'$, (from Greenwich,) it was found that, the current had set her $50\frac{1}{2}$ miles farther, E. $13\frac{1}{2}^{\circ}$ S., being at a mean rate of $12\frac{1}{2}$ miles in 24 hours.

Between lat. $21^{\circ} 24'$, long. $19^{\circ} 26'$, (as above,) and the Isle of Mayo, during an interval of five days, the ship was carried, by the current, $35\frac{1}{2}$ miles W. $30\frac{1}{2}^{\circ}$ S., or at the mean rate of 7.1 miles in 24 hours.

The Solide sailed, on the 18th of January, from Port Praya, St. Iago, on her progress towards Cape Horn; and, although no observation of longitude could be taken, it subsequently appeared, by observations of latitude, compared with the reckoning, that, in the interval from the 28th to the 31st January, the ship was carried to the northward 50 minutes beyond the run by account; that is, at the rate of $16\frac{1}{2}$ miles in 24 hours.

If the reader will cast his eye on the Chart, he will see that, in the interval from the 28th to the 31st January, the ship experienced the effect of a strong current from the southward; she was sailing on that part of the ocean where the waters are most confined between the two continents. It is well known that, on the Coasts of Brasil and Guyana, from Cape St. Roque to the Antillas, the waters have a constant movement from the S.E. to the N.W., declining more or less towards the West, according to the direction of the land. [This movement is now known as the *Equatorial Current*.]

As no observations were made for the longitude since the time of departure from La Praya, it cannot be known whether the current, which set to the northward, set at the same time to the eastward or westward: it may be presumed, that its direction was rather towards the latter; first, because it is well known that the waters between the tropics have a general tendency from East to West; and, secondly, because the observations which were made on the 6th February following, in lat. $5^{\circ} 38'$ S. and $25^{\circ} 38'$ W., indicated, that, in the interval from the 18th of January to the latter day, the ship's progress towards the West had been greater, by about 21 leagues, than that which was deduced from the dead reckoning.

In July, 1792, the Solide returned, to the westward and northward of the Azores; and, on the parallel of $41^{\circ} 42'$, at the distance of about 2 degrees North of Corvo, she had a set in one day of 9 miles S. 29° E. Proceeding thence towards Lisbon, she appeared to have a set, in three days, of $27'$ W. 19° S., equal to $9'$ per day in that direction; but, in the following six days, from the N. E. of the Azores to Cape St. Vincent, the current set $74'$ E. $25\frac{1}{2}^{\circ}$ S., equal to 12.3 per day: and, between Cape St. Vincent, and Cape Spartel, in 42 hours, she found an indraught of 30 miles East, equal to $17\frac{1}{2}'$ per day, setting toward the Strait of Gibraltar.

How far to the southward an easterly current may generally prevail across the Atlantic has not been ascertained; but the following fact may contribute to show where it is not to be found.

On the 19th of October, 1815, Captain Coulson, late of the ship Port Royal, picked up a bottle on the S.E. point of Inagua, near the Island of Cuba. In the bottle was contained the following inscription:—

“This bottle was thrown over-board, from the William Manning, of London, in latitude 35° N. longitude $14^{\circ} 26'$ W. on September 9th, 1810.—THOS. HUSKISSON.

“This is intended to ascertain the current; whoever picks it up is requested to acknowledge it by publication.”

Hence it appears that, during an interval of five years, the bottle had been impelled from the parallel of 35 to that of 21° , and from longitude $14^{\circ} 26'$ to $73^{\circ} 5'$; but we know not either its real courses or the duration of them. Being found on a point of land, it might have been driven thither in a short space, or, it might have traversed the ocean for years, before it was cast ashore. It probably passed to the eastward and southward of the Canaries, along the African coast, whence it took a westerly course.

AFRICA.—The ship MONTEZUMA, of Liverpool, Knubley, master, sailed on the 26th Oct. 1810, for Brasil, but was wrecked on the 23d of the next month, at 3 a. m., on the African coast, somewhere between Capes Noon and Boiador. Among the crew, who were taken and sold by the Arabs, was Alexander Scott, an apprentice; this person was detained in the country for nearly six years; and a very interesting account of his captivity, drawn up by Dr. Traill, with geographical observations on his routes, and remarks on the currents which produced the catastrophe, by Major Rennell, were given in the fourth volume of the Edinburgh Philosophical Journal. The latter are as follow:—

MAJOR RENNELL'S *Remarks on the CURRENTS between Cape Finisterre and the Canary Islands.*

"I should consider myself highly culpable, if I neglected to state, by way of caution to navigators, the result of my inquiries respecting the currents which appear to have caused the shipwreck of the *Montezuma*, and of a great number of other ships of our own and other nations, on the western coast of Barbary; having examined a multitude of journals of ships that have sailed in that track, with time-keepers on board, and which have also, when opportunities presented themselves, had their rate checked by celestial observations.

"The general result is, that navigators, who depart from the parallel of the southern part of the Bay of Biscay, (or say 45° ;) and sail in the usual track southward, will be assailed, first by a *S.E.* current, and then by an *easterly* one, until they have passed the parallel of Cape Finisterre; when the current will again turn to the *south of east*, and gradually become a *S.E.* current, till, having passed Cape St. Vincent, it becomes easterly again; owing, no doubt, to the indraught of the Strait of Gibraltar; and this easterly current is pretty general across the mouth of the bay, between Cape St. Vincent and Cape Cantin.

"Beyond this bay (which may be termed the *funnel*, of which the Strait itself is the *spout*;) the current again becomes *S.E.* or rather more southerly, (as it is more easterly towards Cape Finisterre,) and continues as far as the parallel of 25° , and is, moreover, felt beyond Madeira westward; that is, at least 130 leagues from the coast of Africa; beyond which a *S.W.* current takes place, owing, doubtless, to the operation of the *N.E.* trade-wind.

"The rate of motion of this current varies very considerably at different times; that is, from twelve to twenty or more miles in the twenty-four hours. I consider sixteen as rather below the mean rate. I have one example of 140 miles in eight days, in one of His Majesty's ships; equal to $17\frac{1}{2}$ miles per day; and, in another, of only twelve. And in a very well kept East-India ship's journal, 170 in nine days to Madeira, or nineteen per day. The direction of the stream likewise varies, but commonly more towards the *south* than the *east*, after passing the mouth of the Strait.

"Near the coasts of Spain and Portugal, commonly called the Wall, the current is always very much southerly, owing, perhaps, to the falling in, obliquely on the shore, of the great mass of water brought by the *S.E.* current; which can run off only towards the south, and round Cape St. Vincent towards the Strait's mouth. And amongst the Canary Islands, and between them and the Coast of Barbary, the currents are less regular.

"It may be taken for granted that the whole surface of that part of the Atlantic Ocean, from the parallel of 30° to 45° , at least, and to 100 or 130 leagues off shore, is in motion towards the mouth of the Strait of Gibraltar.

"According to what has been said, in the course of the above remarks, it must be expected that a ship sailing in the usual track to Madeira or the Canaries, will be carried to the *south-eastward* at the rate of sixteen miles *per day*; that is, even if she has a fair wind, she will be carried by the current 150 or 160 miles to the south-eastward, in the course of her voyage to Madeira or the Canaries; and, consequently, on a *S.E.* by *S.* course will be carried eighty or ninety to the eastward of her intended port. If we suppose a *S.E.* course, the error in easting will be no less than 109; which distance, if they are bound to Tenerife, would carry them to Allegranza or Fortaventura; and, if intending to make Allegranza, would place them on shore on the coast of Barbary. The French and Spaniards report that their ships have often made Allegranza when they supposed themselves on the line towards Tenerife. It must be added that, if a ship had a long passage, the error would be greater in proportion, and might possibly amount to 200 miles of casting.

"It would seem advisable, therefore, that every ship going to the Canaries, or intending to sail between those islands and the main land of Africa, and being without time-keepers, as that class of merchant-ships commonly are, should, to every day's reckoning, *add ten miles of easting*. This would, in the first instance, prevent them from

deceiving themselves as they went forward; in like manner, as it is better to set a clock forward at once than to charge one's memory constantly with its being too slow. *Ten miles* does not seem too much as a cautionary measure, as a ship has very lately been carried ninety-nine miles to the east in eight days in that track. What would not have been the error had she had even a moderately long passage?

"It is this current which has furnished the roving Arabs of the Desert with their victims from every nation, and the good Mr. Willshire* with objects of benevolence."

27th Feb. 1819.

CURRENT OF THE STRAIT OF GIBRALTAR.—The flood-tide, on each side of the Strait of Gibraltar, sets outward as already explained on page 77, while the Current from the ocean, with singular exceptions, as shown beneath, sets constantly to the eastward: but the current is, in a degree, regulated by the tide, and will, according to the time of tide, set at the rate of from 3 to 6 miles. Westward of Tariffa, it sometimes, about the full and change of the moon, sets to the westward, quite across the strait; but, eastward of Tariffa it always sets, more or less, to the eastward. To this information, communicated by Mr. *Ignatius Reiner*, Pilot, of Gibraltar, he adds, that, with westerly winds, at the full and change of the moon, the current in the middle of the Strait, between Europa Point and Centa, sometimes sets at the rate of more than 7 miles. At such times, every point in the strait forms an eddy, some of which are heavy and dangerous.

Captain Barret, an old trader to Gibraltar, informed Capt. Livingston, in August, 1820, that, in his last voyage he had found the current set, for about three hours, decidedly to the westward, when he was off Tangier Bay, but the surface water appeared to be going to the eastward, while the westward current had hold of the vessel's bottom. Capt. L. adds, an intelligent master of a London ship says that, when at anchor at Tariffa, he has found the tide run $5\frac{1}{2}$ knots; and Capt. T. Walker says, he has been obliged to have a man at the wheel steering his ship for the tide when at anchor under Cape Spartel. See more upon this subject in our *New Directory for the Mediterranean Sea*, 1825.

Of the irregular deviations of the Gibraltar Current, one of the most remarkable was seen by Captain Livingston, in 1822, when the current in the Strait, instead of setting in to the eastward, *as usual*, was found to be decidedly setting to the westward, all across, for some hours; the flood-tide, (at springs,) having *over-run* the general easterly current, proven by temperature; the water, at the surface, being $4\frac{1}{2}^{\circ}$ warmer than at 6 fathoms down. Several vessels were carried right out to the westward. A Dutchman dodged it on the shore of Spain; Captain Livingston on that of Africa. About seven others, some in the centre of the strait, were carried very near as far as Cape Spartel from opposite Tariffa. Captain L. purposes to explain this subject more at large at a future time.

3. THE AFRICAN CURRENT, or easterly set into the GULF of GUINEA, and westerly outset from the same.

Major Rennell, has shown, particularly by the journals of the Royal Charlotte, East-Indiaman, in 1793, that a current (not altogether continuous from the northward,) sets to the eastward along the Coast of Guinea. This current, inasmuch as it is a continuation of that off the coast already described, winds round in the offing, and nearly in the direction of the bank off the coast, to the S.E. and East; and in the meridian of 11 degrees west, has been found to set at the rate of 25 miles to the E.S.E. in the 24 hours. Increasing in strength off Cape Palmas, it there sets to the East, at the rate of 40 miles: off Cape Three Points, and thence to the Bight of Benin, at the rate of from 30 to 15 miles; thence decreasing, to the south-eastward, it continues with diminished strength, winding to the southward, past Cape Lopez, &c. whence it revolves to the S.W., between the parallels of 6 and 8 degrees South of the line, and thence to the N.W. towards Cape Verde and the Cape Verde Islands.

The prevalence of the Harmattan wind, which has been described, must interrupt the course of this current; but its existence, at other times, nearly as described, has long been confirmed, and is incontestible. The reader may, however, here refer to the remarks of M. la Pérouse, on crossing the line, page 59.

* William Willshire, Esq. the English consul at Mogodor, to whose active goodness Scott and many others owe their deliverance from slavery.—EDIT.

Near CAPE MOUNT, the current sets in towards the shore. On the western side of *Cape Palmas* it sets along shore with such force to the S.E., that ships, which do not steer a point nearer than the true course, will be carried from the land. About *Cape Three Points*, likewise, the stream runs strongly to the eastward, and frequently sets directly in upon the reefs about that cape. Eastward of this cape the current has carried many experienced mariners, bound to Cape Coast or Annamaboe, to leeward of those ports, and occasioned much trouble, with delay, in beating up again. About *Cape Formosa*, in July and August, the current has also been found to set strongly to the eastward.

It is, however, said, that the currents are variable on the Grain Coast; sometimes running to the N.W. That they set mostly between North and East, across the Gulf from Cape Palmas to Cape Lopez; particularly from the coast to latitude 2° N. From 2° N. to 1 or 2° S., the current frequently sets strong to the westward; especially when the sun has great northern declination.

The Current which sets westerly to the southward of the Line, and from the Bight of Biafra, has been illustrated, as already explained, in our '*Memoir on the Ethiopic Ocean*,' by Mr. Jas. Finlaison. That gentleman has shown, how, by taking advantage of it, ships may effect, without difficulty, a passage from the Bight to Sierra Leon. His instructions are as follow:

"SHIPS bound from the Bight of Biafra to Sierra Leon, if from Calabar River, when the wind does not permit them to proceed by the N.W. of Fernando Po, may pass between that island and Camaroons River, when they will find a strong current setting to the southward, out of the River del Rey. After they have advanced to the southward of Fernando Po, they must endeavour to make all the southing and westing they can; passing either to the eastward or northward of Prince's Island, as winds will permit. On the east side of this island, the current sets strongly to the southward, at the rate of a knot and a half: westward of Prince's Island, it generally sets strongly to the N.E., at the same rate.*

"Having arrived to the southward of Prince's Island, if the ship will lie no higher than W.N.W., tack immediately, and try to cross the Line; for, by so doing, you will keep out of the strong N.E. current that sets towards the bights of Benin and Biafra. After you have crossed the Line, you will find that you are nearly out of the easterly current. In the parallel of one degree south, you will find the current set to the westward, at the rate of one mile an hour. In the month of May or June, when the sun has a high declination, the trade-wind is far to the southward, and you will not gain the regular breeze nearer than in three degrees south. This breeze commences from S. by W. As you make westing, the wind will be found to haul more to the southward and eastward, and the current increases to the rate of a knot and a half in an hour, until you arrive as far to the westward as 15 degrees west. On proceeding hence to Sierra Leon, come no farther to the eastward than 15 degrees west, until you are as far to the northward as $8^{\circ} 30'$ N.; then you may steer boldly in for the Cape. You will strike soundings in that parallel, in $14^{\circ} 40'$ W.; and, as you approach the Cape, the soundings will be found very irregular, from 20 fathoms to 12 at a cast. You will then be 7 leagues from the Cape, and in the fair track of the river.

"Having given these directions to our Prize-master, they generally made the passage from Fernando Po and Bonny in five weeks; merchant-vessels have frequently been three months, by keeping in-shore."

4. CENTRAL CURRENTS, between the AZORES and BERMUDAS, &c.

The Easterly and South-easterly Currents, which have been described in our preceding pages, are blended, in their southern regions, with the *Florida* or *Gulf Stream*, described hereafter, and they do not seem to prevail to the S.W. of the Azores. On the

* In the last edition of the *Derrotero de las Antillas*, the following remarks are said to have been found among the papers of the deceased Admiral Don Josef Varela. "At Prince's Island, and in its vicinity, the waters generally run to the North, which circumstance ought to be kept in mind in making the island and steering for the anchorage. There are also currents to the south, but they are not so strong, or of so long duration. The pilots of the place say that the currents depend on the phases of the moon, but we found that they were irregular." From this, we may infer, that there is some irregularity in the outset or revolving current; for which, consequently, every precaution should be taken.

contrary, to the W.S.W. and S.W. of those islands, the Currents appear to follow the course of the Trade-winds, towards the Caribbean Sea; and to the southward of the Tropic they blend with the *Equatorial Current*, which sets from E.S.E. to W.N.W. and West. Towards the west, they occasionally extend to the northward of the Bermudas; and, even unite with the southern edge or *reflow* of the Gulf-Stream. The existence of these currents have long been known, but a farther examination, and more precise information, are still *desiderata*. The recent examples of them which we have to adduce are not numerous, but they are satisfactory; they also accord with natural facts, and are in unison with that theory which derives its currents from the rotatory movement of the earth and the operation of the Trade-winds.

Captain J. W. Montearth, on his passage from Liverpool to Norfolk, in Virginia, in February, 1816, between the island of Terceira, Azores, and latitude 32° long. 45° , in a run of eight days, by lunar observations, found the current had set the vessel *three degrees* to the W.S.W. of the reckoning: but from this position, until his arrival in the Florida Stream, little or no current was found.

A bottle thrown into the sea, from the ship *William Manning*, in latitude 35° , long. 14° , and found near Cuba, has been heretofore noticed, page 98.

Capt. W. J. Capes, in the *Lady Macworth*, (vide page 94) in September, 1823, from the 14th of that month to the 8th of October, pursued his direct course to Barbadoes, from lat. $24^{\circ} 0'$ long. $25^{\circ} 1'$ his situation at noon on the 14th. He says that, from leaving the island Ferro, we found the current setting us at the rate of from 3 to 5 miles a-day westward, and generally a little southing. The weather was remarkably fine all the way to Barbadoes, and always fair, so that I never took in a royal: the log-glasses well adjusted, as well as the log-line; but, on making Barbadoes, we found the chronometer to be remarkably correct, and that the ship was 112 miles a-head of dead-reckoning.

To the above we shall only add that, on the 25th of November, 1790, the merchant-ship *Rosalia* sailed from Cadiz for Vera-Cruz, having, as passengers on board, Don Josef de Espinosa and Don Ciriaco Cevallos, officers of the Spanish navy, who had two good chronometers. This ship made Cape Cabron, on the N.E. side of St. Domingo [Hayti] after a voyage of twenty-three days, and it was then found that the Currents had carried them *four degrees* to the westward of dead-reckoning; and that, consequently, the daily drift averaged about 7 miles.

5. THE EQUATORIAL CURRENT, or CURRENT from the EQUATOR to the ISLAND of TRINIDAD and CARIBBEAN SEA.

The action of the S.E. trade-wind, in the equatorial regions, and the apparent disposition of the waters in these regions to retire westward, which have been attributed to the rotatory motion of the earth, are considered as the causes of a current which is known to flow, during great part of the year, from the Ethiopic Ocean to the Caribbean Sea, and which has frequently carried ships considerably to the West and W.N.W. of their reckonings, when off the N.W. part of Brasil.

The Current from the Indian Ocean, setting over the Bank of Agulhas, past the Cape of Good Hope, and to the north-westward beyond St. Helena, &c. is here united with the *Equatorial Current*, which thence form one great volume or continued stream.* Of this stream the western border is controlled and variegated by the South-American coast and West-Indian waters, while the northern and eastern borders run to the west, north, and N.E. In the last two directions from the Equator, in about 23° of longitude, towards Cape Verde and the Cape Verde Islands. Beyond the parallel of these islands, a gentle *westerly current* marks the boundary of the Equatorial stream on the east, and commonly pursues its course so as to form a junction with it on the west. The last effect has been noticed in the remarks on the Central currents above.

With the greatest velocity of the Equatorial current we cannot pretend to be accurately acquainted. Its central direction, when in full force, is W.N.W. and generally, it is imagined, about one mile and a half in the hour, but increasing to the westward; so that off the coast of Guyana it commonly sets at the rate of two or three miles.

* For the CAPE CURRENT, as described by Major Rennell, &c. see our Memoir on the Ethiopic, or Southern Atlantic Ocean, pages 136, 7.

Near the parallel of 10° N. the Currents produced by the N.E. and S.E. trade-winds may be imagined to unite; and this united stream, being divided by the island of Trinidad and the Southern Antillas, thence passes into the Caribbean Sea.

From the mouths of the Marañon, Orinoco, and other rivers, a vast efflux of water falls into the Equatorial Sea, more particularly in the wet season: what effect this water may have on the current is at present unknown.* But we learn, from the *Derrotero de las Antillas*, that, "Off the coasts of Guyana there are two currents: 1st, The general or equinoctial current, and another caused by the tides; the boundary of the first is twelve leagues from shore, or in the depth of 9 fathoms of water, from which, towards the shore, that of the tide is experienced. The ebb sets to the N.E., and the flood towards shore. In the Gulf of Paria, also, the tide influences the currents.

"In the southern straits, or channels, of the Antillas, the velocity of the current inward is seldom under a mile an hour; but its changes are so great, that it is impossible to point out its exact direction, or to establish any general rule for its velocity."

The following facts establish the existence of the combined current; and they show, in some degree, its force and direction towards the Brazilian coast.

1. In June and July, 1795, the Bombay Castle, East-Indiaman, between the Isle of Palma (of the Canaries) and the Coast of Brasil, experienced a westerly current, amounting to $6\frac{1}{2}$ degrees.

2. On May 20, 1802, the Cuffnells, East-Indiaman, lost the N.E. trade in $8\frac{1}{2}^{\circ}$ N. long. 22° . Gained the S.E. trade, June 4, in 5° N. long. 21° . From the equator the current was found to set W. and W. by N. from 30 to 52 miles daily, till the coast of Brasil was in sight on the 14th, in 8° S.

3. May 23, 1802, the Sir Edward Hughes lost the N.E. trade in 6° N. long. 23° , and the wind was from S.S.E. on the 25th in 5° N. and 23° 30' W. The trade kept far at southward, and the current set strongly to the West.

4. October 16, 1805, the Europe and fleet lost the N.E. trade in 11° N. long. 28° , and gained the S.E. trade on the 20th, in 4° N. long. 29° . On the 4th of November, the land of Brasil was seen in lat. 6° S., the wind near the land was at E. by S. and E.S.E. By proceeding too far to the westward, two ships of the fleet were wrecked in the morning of the 1st of November, on the Roccas, or low Kays, in lat. 3° 52' S. and $33\frac{1}{2}^{\circ}$ W., and several others had nearly shared the same fate. This catastrophe had probably been avoided by a due knowledge of, and attention to, the effects of the current; which was subsequently ascertained to set $2\frac{1}{2}$ miles per hour to the westward, near the Roccas.

5. On the 1st of June, 1793, the King George, East-Indiaman, crossed the line in 30° W., and, from the second to the fifth, experienced a westerly current of 1° 33'. On the 5th, Cape St. Roque was in sight, and the ship was kept working until the 10th, endeavouring ineffectually to weather it; she then stood to the north-eastward, closely hauled, to latitude 1° N., in order to regain the variable winds in North latitude, and then proceeded to cross the equator, which was, at length, effected.†

6. In May and June, 1807, the transports, laden with ordnance-stores, for the army at Monte Video, by crossing the equator too far to the westward, were carried so far in this direction by the current, that they could not get to the southward of Cape Augustin, (lat. 8° 23' S.) and were twice obliged to stand to the northward, into variable winds, to regain Easting, after having attempted ineffectually to gain the regular S.E. trade-wind.

7. It is a well-known fact, that several ships have made the isle of Fernando Noronha,‡ on their outward-bound passage to India, by the currents having set them to the westward, after the failure of the N.E. trade-wind. The current runs strongly about this island.

* M. de Humboldt says, however, that the influence of the most considerable rivers of America such as the Marañon, the Orinoco, the Magdalena, and the Mississippi, is restricted within much narrower limits than is generally thought.

† In latitude 5° 6' S. longitude 35° 43' W. to near the coast and the meridian of 38° , the *Inconstant* frigate was carried by the current 47 miles N. 73° W. in 24 hours, 1st April, 1814.

‡ Latitude 3° 54' S. longitude 32° 21' W. or thereabout.

8. *And*, in 1770, a small vessel laden with corn, and bound from the island of *Lanzarote*, one of the Canaries, to Santa Cruz, Tenerife, was driven to sea, while none of the crew were on board. The motion of the waters, to the south and west, carried it to America, where it went on shore, at Guayra, near Caraccas.

9. *CAPE VERDE ISLANDS TO HAYTI*.—A bottle from the ship *Duke of Marlborough*, by Mr. Geo. Thom, in latitude $16^{\circ} 22' N.$, longitude $26^{\circ} 31' W.$, 14th of October, 1820. Found, 24th of July, 1821, at *Agujero Chico*, or *Petit Trou*, on the south coast of Hayti, in latitude $17^{\circ} 54' N.$, longitude $71^{\circ} 8' W.$, and made public by Captain James Robinson, of the brig *Endeavour*, of Liverpool.

10. *EQUATORIAL CURRENT TO TRINIDAD*.—A bottle, (No. 267,) from the *Osprey*, of Glasgow, at noon, on the 17th of January, 1822, in latitude $6^{\circ} 13' S.$, and longitude $15^{\circ} 35' W.$ Found on the 27th July, 1822, in Mayaro Bay, Island of Trinidad, latitude $10^{\circ} 15' N.$, and longitude $61^{\circ} 2' W.$

11. *EQUATORIAL CURRENT TO TOBAGO*.—A bottle from the schooner *Julia*, Wm. Davidson, master, in latitude $6^{\circ} N.$, and longitude $40^{\circ} W.$, Nov. 6, 1821. Found 7th of March, 1822, near the shore of Little Rockly Bay, Tobago.

12. *EQUATORIAL CURRENT TO MARTINIQUE*.—A bottle from the ship *Osprey*, of Glasgow, latitude $5^{\circ} 12' S.$, and longitude, $24^{\circ} 40' W.$, 28th of March, 1820. Found 4th of February, 1821, near the eastern point of the Salines, quarter of St. Anne, Island of Martinique. Attested at St. Pierre, Martinique, 13th of February, 1821, by Monsieur T. Bournant, Printer, and Director of the General Post-Office at that place.

13. A bottle, thrown from the *Osprey*, at noon, on the 1st of April, 1820, in latitude $12^{\circ} 56' S.$, longitude $29^{\circ} 10' W.$, was found 10th of June, 1820, on the Barra Grande, coast of Brasil, latitude about $9^{\circ} 20' S.$ Its true direction seems to have been N.W. by W. $\frac{1}{4}$ W. Attested by Messrs. Lowe and Co., of Maçao, in the province of Pernambuco.

14. *CAPE VERDE ISLES TO BRASIL*.—The Hazard, of Greenock, August 4th, 1812; lost the N.E. trade in latitude $11^{\circ} N.$, longitude $25^{\circ} W.$; and the wind, until the 12th, varied from West to S.W.: from the 12th to the 17th it generally blew from South, never exceeding one point easterly. Gained the S.E. trade on the 17th, in latitude $2^{\circ} N.$, longitude $27^{\circ} 30' W.$; the trade kept southward between Penedo de S. Pedro, or St. Paul's Island, and the coast of Brasil (at Rio Doce) and experienced a westerly current amounting to nearly four degrees. Attested by Capt. J. W. Montearth.

Thus, as M. de Humboldt says, "The discovery of a group of uninhabited islands is less interesting than the knowledge of those laws which link together a considerable number of insulated facts."

It has been shown in our volume on the Southern Ocean, that, on the Eastern Coast of Brasil, between the months of September and March, the winds generally prevail from N. by E. to N.E. by E.; between March and September, the prevailing winds are from E. by N. to E.S.E.

The former of these is generally termed the *NORTHERLY MONSOON*, and the latter the *Southerly* one; although there appears, in fact, to be no direct and opposite change in them on or about the equinoxes, as is generally the case with the winds so called. These winds being simply a continuation of the S.E. trade, which changes its direction as above described, and as influenced by the land on its approach thereto.

Under the operation of the winds, and according to their changes, the currents must, consequently, vary; and a reasonable allowance for them will be made according to the judgement of the navigator.*

From the month of March to that of September, it may be presumed that they set most to the northward; on the contrary, between September and March, more to the southward.

There can scarcely be a doubt that, with change of season, there is a considerable variation in the course and breadth of the Equatorial Current. Northerly winds may press it towards the shore of Guiana, &c., and other circumstances disperse it over the ocean to the eastward. Of such variations a singular instance has been related in the Spanish *Derrótero*, which appears quite contrary to preceding experience; but it is given on the most respectable authority, and is, therefore, subjoined.

* See farther, as to those on the Coast of Brasil, *Memoir for the Ethiopic Ocean*, page 59.

The deceased Admiral Don *Cosmé de Churrua* (as before mentioned, page 96) sailed from Cadiz, on the 15th June, 1792, for the purpose of surveying the West-India Islands and Spanish Main. On the 6th of July he crossed the Tropic of Cancer in $28^{\circ} 56'$ West of Greenwich, without having discovered any error in the dead-reckoning: neither did they find any on the 8th; the trade-wind was then fresh, and it was remarked that it attained the greatest strength when the sun was on the meridian, by night as well as by day. This phenomenon, which continued during the subsequent days, is precisely contrary to what had been observed when the sun was to the southward of their zenith; and, the writer observes, "according to the general theory of the winds, it appears that the breeze ought to freshen when the sun passes the meridian, in all cases except when the declination is equal to the latitude in which the observer is placed. It is desirable that all navigators should note in their journals the times and circumstances under which they experience the greatest and least force of these general winds; for such observations, frequently repeated, might furnish knowledge which is a *desideratum*."

"On the 10th of July they found a current of one mile and a tenth per hour, setting N. 40° E., reckoned for two days; care had been taken to heave the log very frequently, and always on any alteration of the sail carried. Their course was S. 64° W. From the 10th to the 12th they also found a current setting N. $31\frac{1}{2}^{\circ}$ E., nearly a mile an hour; from noon of the 12th, to noon of the 14th, the current had carried the vessel to the N.E. $44\frac{1}{2}$ miles out of her course: and at noon of the 15th, 17 miles N. 21° W.

"At noon of the 17th they found that, in the preceding 48 hours the vessel had been carried 43 miles to the N.E. of her reckoning. On the 18th, in the evening, they saw the island Tobago bearing S. 55° W. By making this island they found that the reckoning by account was $2^{\circ} 13' 45''$ a-head of the ship; equal, in this parallel, to $43\frac{1}{2}$ leagues; and Don Cosmé thereupon made the following reflections:—

"In ten days, between the parallels of $21^{\circ} 45'$ and $11^{\circ} 44'$, and the meridians (West of Greenwich) of $33^{\circ} 30'$ and $59^{\circ} 50'$, the vessel was set $2^{\circ} 48' 27''$ to the north, and $2^{\circ} 27' 45''$ to the east, of dead-reckoning, or $71\frac{1}{2}$ leagues, as if they had experienced a daily current of $21\frac{1}{2}$ miles, setting N. 38° E. This great error cannot be attributed to any carelessness in making up the dead-reckoning, nor to its insufficiency; for it is known that a log-line marked to 50½ English feet, between knot and knot, ought not to measure distances greater than those sailed; and, consequently, it must be concluded that they had a constant and powerful current setting them to the N.E.

"There can be no doubt, Don Cosmé says, of the existence of a current to the westward in the tropical zone: the action of the moon must necessarily produce it; and the experience of navigators who have generally found their vessels a-head of their dead-reckoning on making the coast of America. The constant action of the trade-winds must also co-operate, and it would be temerity to oppose an opinion so satisfactorily established, and so generally adopted. My own observations are, however, certain; my dead-reckoning was most circumspectly and prolixly made up, and there can be no possibility of a doubt that we experienced a current to the N.E. The thing is certain; and now let us try to reconcile these circumstances, which appear so contradictory.

"From the month of May till November, the rains are continual and copious on the continent and islands of America; in consequence of which the rivers ought to be increased, not only in size, but in velocity of movement. The number of these rivers is very great, and their united action must be very considerable on the waters of the ocean; and it may be the mean of destroying the Equatorial Current, and of making one in a different direction. On the one hand, as the rainy season is also the season of the hurricanes, and that in which least navigation is carried on, the currents during that period have been less particularly (or seldomer) examined; and consequently little is known of the currents produced by the rivers; while, on the other side, as the principal navigation is made in the months which have no rain, and in which the rivers have no considerable force sufficient to destroy the Equatorial Current, it follows that the majority of navigators find currents setting westward.

"Should the foregoing reasons prove correct, it will follow that, from November till March, currents may be found setting to the westward, and during the other months of the year to the north-eastward."

It may be seen, by reference to our next division, on the currents of the Caribbean

Sea, &c., that this idea of the Spanish commander is not merely chimerical. For it is shown that, during the rainy season, the current on the Colombian shores often sets to the eastward; thus uniting with the Equatorial Current, and forming an outset from the Caribbean Sea. There may probably be, at all times, a southerly reflow on shore.

6. THE CURRENTS OF THE CARIBBEAN SEA AND MEXICAN STREAM.

"On the Colombian coast, from Trinidad to Cape la Vela, the current sweeps the frontier islands, inclining something to the south, according to the Straits which it comes from, and running about a mile and a half an hour, with little difference. Between the islands and the coast, and particularly in the proximity of the latter, it has been remarked that, the current, at times, runs to the West, and at others, to the East. From Cape la Vela, the principal part of the current runs W.N.W.; and, as it spreads, its velocity diminishes: there is, however, a branch, which runs with the velocity of about a mile an hour, directing itself towards the coast about Cartagena: from this point, and in the space of sea comprehended between 14 degrees of latitude and the coast, it has, however, been observed, that, in the dry season, the current runs to the westward, and in the season of the rains, to the eastward.

"On the Mosquito Shore, and in the Bay of Honduras, no rule can be given for the alterations of the current. All that can be said is, at a good distance from land, it has generally been found setting towards the N.W.

"In crossing from the coast, or from Cartagena, to the islands, it has been observed, that, from La Guayra, to the eastern part of St. Domingo, on a voyage made in December, a difference of 106 miles to the westward was found during the seven days the voyage lasted."*—*Derrotero de las Antillas*.

Mr. Town, in his Directions for the Colombian coast,† has said, "Although, between the Island of Jamaica and the Spanish Main, westerly currents are most frequent, yet they do not always prevail; for ships have been known to be driven by the current from 50 to 60 miles to the eastward, in four or five days. From the beginning of May till November, (the rainy season,) the sea breeze seldom or never blows home to the main: and ships going there should never go to the southward of the latitude of 11°, until they are, at least, 40 or 50 miles to the westward of their intended port; after which they may make a south course, as the land-breeze, which is generally from the S.W., and the strong easterly current, will set you to the eastward of your intended port, if great care be not taken. When to the eastward, if light winds prevail, you must stand to the northward until you meet the sea-breeze, which will be between the latitudes of 10 and 11 degrees, and then run to the westward.

"Being off Porto-Bello, in his Majesty's ship Salisbury, on or about the 12th of August, 1810, and being a little to the eastward of that port, with light variable winds for several days, the ship was set to the eastward, at the rate of fifty miles per day; and, having been afterwards placed in the same situation, I found it necessary to make the land well to the westward, and to keep close to it. From November until May, (the dry season,) you should endeavour to make the land well to the eastward, and run along shore; as the sea-breezes generally blow very strongly, and the current sets to the westward at the rate of about two or three miles in an hour.

"Between Chagre and Porto-Bello, during the rainy season, there is generally a northerly current, at the rate of from one and a half to two and a half miles an hour. After the end of the rainy season the current sets to the southward and westward, and strong

* The Baron Alexander de Humboldt, in describing his passage from Cumana, westward, to Guayra, has said, "The general motion of the waters between the tropics toward the west, is felt strongly on the coast during two-thirds of the year only. In the months of September, October, and November, the current often flows towards the East, for fifteen or twenty days in succession. Vessels on their way from Guayra to Porto-Cabello have been known to be unable to stem the current that runs from West to East, although they had the wind astern. The cause of these anomalies is not yet discovered. The pilots think that they are the effect of some gales of wind from the N.W. in the Gulf of Mexico. Yet these gales are much more violent in spring than in autumn. It is also remarkable that the current to the East precedes the change of the wind. It begins to be felt, at first, during a calm; and, after some days, the wind itself follows the current, and becomes fixed in the West."

Personal Narrative, Vol. III. 378.

† See the *Colombian Navigator*, Vol. II. page 136.

southerly and easterly winds prevail here. From November until May (the *dry season*), the southerly and westerly are very light winds, except in squalls, which end with heavy rain. In sudden squalls, you will often have the winds from all points of the compass.

"If at Chagre, at any time during the rainy season, (May till November,) and bound to the eastward, endeavour to get four or five leagues from the land, so soon as you can; for the winds are, in general, very light, and the current very strong. The latter sets from Chagre directly on the rocks of Porto-Bello, and thence along the land from E. by N., E.N.E., E.S.E., and according as the land lies: its general rate being from one and a half to two and a half miles in an hour. Great care should be taken when near the land, if a heavy squall and rain appear to be coming on. During this you will have the wind from all points of the compass, and often so strong that all sail must be taken in.

"In crossing the Gulf of Darien, little or no current will be found; whenever there is any, it sets about South, S. by W. or S. by E., up the Gulf.

"Near Cartagena the current generally goes with the wind; but off the Islands of Rosarito it sets to the N.W. and N.N.W., from one to two miles an hour.

"Between Cartagena and the Magdalena, in the rainy season, you cannot put any dependence on the winds or currents; but, from November to May, the trade-wind blows home.

"I should recommend, if turning to windward, with strong trade-winds, to keep the shore close-to: whereas, by going off from the land, you will not only have a heavy sea, but also a strong N.W. current. If you have light variable winds, approach no nearer to the land than 4 or 5 leagues, as you may be certain of an easterly current."

Captain Livingston says, "During five weeks in which I remained at Cartagena, in June and July, 1817, the current in-shore set constantly and strongly to the northward, at a rate, I am convinced, of not less than a mile and a half an hour, or nearly as strong as the Missisipi at New Orleans, I have seen the *Esk*, sloop of war, current-ride against a very fresh sea-breeze, when at anchor, nearly west from the city, distant about a mile."

Upon the CURRENT between the GRAND CAYMAN and CAPE ANTONIO, Captain Monteath has said, "In the months of May, 1814 and 1815, (two voyages in which I was chief-mate of the ship *Prince Regent*, from Kingston,) in June, 1817, in the ship *Fame*; and in April and December, 1820, in the ship *Mary*, between Grand Cayman Island and Cape Antonio, I invariably found the current setting strong to the eastward, or E.S.E.; and I have heard it generally remarked that, vessels shaping a course from the Caymans for Cape Antonio, have found themselves off, or even to the eastward of, Cape Corrientes: this has, in the above cases, invariably happened to myself.

Farther on, "In my passage from Kingston, towards Campeché, in the ship *Fame*, June, 1817, between Cape Antonio and Cape Catoche, I found the Current to set due North, 27 miles in a run of 18 hours.

We have already given, in the preceding page, the remark of the Spanish navigators on the currents of the Mosquito Shore and Bay of Honduras. We now add those of our friends Captains W. J. Capes, of London, and John Burnett, of Port-Glasgow.

Captain Capes says, "Between JAMAICA and BONACCA the current generally sets to the northward and westward. Here, in May, 1816, I was set 60 miles to the westward by the current, and found that it set rather northerly, from one quarter to half a mile an hour. Between Jamaica and Bonacca are the islands called the Swan Islands, in latitude $17^{\circ} 22'$, long. $83^{\circ} 36'$. I would not advise any one bound to the Bay to make these islands, for it cannot be of service, and the current is so very irregular about them, that the attempt serves only to bewilder the navigator; and, by falling in with them in a dark night, a ship would be in danger of running on shore, as the land is very low.

"About the SOUTHERN FOUR KAYS the currents are very uncertain. I have known three ships to be lost on these Kays by lying-to for the night, after they have made them; for, at all times, the current sets strongly on them; and, in two of the cases, the ships wore every two hours, with an intention to keep their station. In one voyage I took my departure from Bonacca at four p.m. with a strong breeze from the East, which continued till midnight; it then died away, (no uncommon circumstance in this part,) so that I did not lift the Southern Four Kays before four p.m. the next day, from the foreyard. I then made all snug, and plied to windward, under single-reefed topsails and topgallant sails over them; tacked ship every three hours, during night, and, to my sur-

prise, in the morning, we were not more than one or two miles to windward of them ; so, if I had hove the ship to, I have no doubt but she would have been driven on shore by the current.

“ If a ship be lying-to, under RATTAN, it will not be amiss to try the current. It is my opinion that the current about Bonacca takes two different directions ; one part setting to the N.W., and the other part branching to the S.S.W. I have found it so on several trials, which is the reason that I prefer taking a departure (for the Bay) from the middle or East end of Rattan : for, if a ship take her departure from the West end, her course will be N.N.W. ; but it very frequently happens that ships get down on those reefs when they take their departure from the West end. The reason is this : a ship steering N.W. from the West end has more of the current on her beam, which sweeps round the West end of Rattan, very strong at times ; consequently, ships that take their departure from the East or middle part do not feel so much of the current.”

Captain Burnett, in his directions for sailing from the BAY of HONDURAS, says, “ When the trade-wind prevails, a current, often very strong, sets down between Mauger Kay and the Northern Triangle ; there, dividing itself, it sets to the southward, between Turneff and the Main Reef, and to the northward between the Triangle Reef and Ambergris Kay. It is most advisable, with the wind from East to E.S.E., to sail to leeward of the Triangle, as you will have a strong current in your favour so soon as you bring it to the eastward of you.

“ In the channel, between the island Cosumel and the shore, the current along shore runs at the rate of nearly $2\frac{1}{2}$ miles an hour, till lost in the Mexican Sea.”

MEXICAN STREAM, &c.—It is, we believe, a well-established, although a controverted, fact, that there is a constant indraught on the *western* side of the CHANNEL of YUCATAN, into the Mexican Sea ; and that there is commonly a reflow on the *eastern* side of the same channel, around Cape Antonio, &c.

With the former in its favour, his Majesty's ship *Resistance*, Captain Adam, off the Bank of Yucatan, made a course W.N.W. $\frac{1}{2}$ W. nearly 80 leagues in the 24 hours, December 16 and 17, 1806 ;* and we have no doubt that many instances may be found to prove the same effect ; on the Cuba side only, it appears that vessels have been set to the southward ; and Captain Manderson has stated that, when a strong easterly wind has been blowing between Cuba and Florida, vessels heaving-to off the South side of Cape Antonio, at about two leagues from shore, have, in the course of one night, been carried against a strong sea-breeze, nearly as high as Cape Corrientes, being a distance of 10 leagues.†

The ship *Carshalton-Park*, Captain J. Steele Park, sailed from Jamaica for London, on the 20th of May, 1824. At noon on the 27th she was off the S.W. side of Cuba, in latitude $21^{\circ} 26'$, longitude, by chronometer and lunars, $84^{\circ} 47'$ W. Here was discovered a current setting to the N.W. at the rate of two miles an hour. At 7 h. 30 m. Cape Antonio bore N.W. 5 or 6 miles. “ The current to the N.W.,” says Capt. Park, “ swept us into the Gulf of Mexico ; and there we were beating about, three or four days, making nothing and westing in spite of our teeth. All this time the wind was easterly, and we might have cruised about there till Christmas, had the wind not got a little to the southward of east, which enabled us to get over to the N.E. side, where we found the Current running directly opposite to the former,” being now in the Florida-stream.

From CAPE ANTONIO the current sets, at times, to the E.S.E., past the Isle of Pines. Captain Livingston has informed us that, in March, 1818, he found the current between the Great Cayman and Isle of Pines to set in that direction, at the rate of fully two miles and a half in an hour, or 60 miles in the 24 hours. In August, 1817, he found the set nearly the same, but the current not half so strong. The Spanish Directory says, ‘ From Cape de Cruz, on the South side of Cuba, it is noticed that there is a constant current to the westward, with some inclination to the southward or northward, and which has been known sometimes to set 20 miles in a single day.’ In opposition to this, the exact words of Captain Livingston are, “ I have twice experienced a strong current setting about E.S.E., between the Caymans and Isle of Pines ; and, on the

* The northernmost part of the track extended to $24^{\circ} 50'$ N., in longitude $90^{\circ} 39'$.

† Our friend Captain Rowland Bourke, when once lying-to for the night, off Cape Antonio, found himself next morning off Cape Corrientes.

latter of these occasions, both my mate and myself separately calculated it to set about 60 miles per day, or $2\frac{1}{2}$ per hour. This, however, I incline to think a very particular case, such as may but seldom occur. The winds at this time were light and westerly. On the other occasion, so far as I recollect, it set about 12 or 14 miles per day only. All my papers on these subjects have been lost; but the first instance was too remarkable to be forgotten."

On the northern coast of St. Domingo, and in the Windward Passages, there does not appear to be any general current. On the North side of Cuba the case is nearly the same; but in the channel here is a regular tide throughout the year, subject, however, to certain variations.

The currents of the Caribbean Sea are probably varied by the influence of the moon and change of seasons, and combine, in some degree, with the tides; especially about Cuba, Jamaica, and St. Domingo.*

In an old book, already noticed, (Kelly's Navigation, Vol. I. 1733,) is an abstract from a journal, which contains the following passage:—"Between the West end of Hispaniola and the island of Jamaica, if I took my departure upon a full or change of the moon, I found that I made many leagues more than I did at the quarters of the moon. At the full and change, I was looking out for the land long before I saw it; and, at the quarters, I was down upon it long before I looked for it. The reasons, as I found afterwards, were, that the full and change made a strong windward current, and the contrary on the quarters. This has been exemplified in many instances."

On this subject Captain Livingston says, "It is a prevailing opinion with many, that the moon governs entirely the currents among the West-India Islands. No doubt the moon has some effect on them, but I am of opinion that the winds have still a more powerful influence.

"It is rarely, indeed, on the North side of the island of Jamaica that there is a westerly current when the North and N.W. winds prevail; the current then always, or almost always, setting to the eastward.

"On the South side of Cuba, when the wind is westerly, which it often is, you are always certain of a re-flowing current round Cape Antonio. This is easily accounted for; as, when the fresh trade-wind ceases, and the westerly winds set in, the barrier is, in some degree, removed which confined the waters in the Gulf of Mexico, and they seek to regain their level as well by the Channel of Yucatan as by the Strait of Florida."

In the Windward Channel of Jamaica the current generally sets with the wind to leeward or S.W.; yet, both here and at Jamaica, it is variable. Some have affirmed that, when a current runs to leeward, on the South side of Jamaica, there is frequently one setting eastward on the North side; and, at other times, no current is to be perceived; also that, when a lee-current runs on the North shore, the same circumstances may be perceived on the South shore as were before observed on the North.

But between the Mona Passage and the Caymans, South of the islands, the tendency of the currents toward shore is most commonly found to be to the north-westward.

In the Bahama Passages the currents are devious; both weather and lee-currents having been found. These, also, appear to be influenced by the tidal causes; for the tides are operative on the Banks, and sometimes set strongly.

THE FOLLOWING is an additional DETAIL of the best information we have been able to collect, of the Currents in the Caribbean and Mexican Seas, from the *Derrotero de las Antillas*, &c.

In the Channel between Trinidad and Granada the current has been found to set nearly West; on the South side half a point southerly, and on the north side half a point northerly. Its velocity from a mile to a mile and a half per hour.

Between Granada and St. Vincent's, among the Granadines, the currents are devious; but the general inset appears to be W. by N.

* Captain Coulter, of the ship Robert, from the Clyde, some years since threw a bottle overboard to the eastward of Alto-vela, on the south coast of Hayti, and about thirteen months afterward he saw a Charleston newspaper, at Kingston, Jamaica, which stated that the bottle had been picked up on the shore, near St. Mary's, in Florida.

Between *St. Vincent's* and *St. Lucia* the current, from the eastward, sets in more northerly; and within, on the West, it has been found setting to the N.W. Between these islands it seems to be as strong as in any other part of the range.

Between *St. Lucia* and *Martinique* it has been found nearly North. Very variable on the western side of the latter.

The current sets nearly in the same manner between *Martinique* and *Dominica*; but, to the north-westward of the latter, it has been found nearly S.W. $\frac{3}{4}$ of a mile hourly. Northward of *Guadaloupe* it sets W. $\frac{1}{2}$ S., and between *Montserrat* and *Antigua* N.W.

Between *Redonda* and *Nevis* it has been found W.S.W. half a mile hourly.

Without *Barbuda* and the northern isles, it has set about W. by N., and to the northward of the Virgin Isles and Porto-Rico about W.S.W.

At the distance of about one degree, within the range of the *Caribbee Islands*, and to the Virgin Islands, the Current has been found setting, in general, to the W.N.W., from one mile to one mile and a half an hour.*

In the *Mona Passage*, between Porto-Rico and Hayti, the current has been marked as frequently setting to the N.W., and we have instances of a set through to the S.W., but Captain Monteath, in February, 1816, when proceeding southward towards Porto-Rico, in from latitude $23\frac{1}{2}^{\circ}$ to 22° and longitude 64° to 65° , found the current setting N.N.E. at the rate of 20 miles in the 24 hours: and he says that, off the N.W. end of Porto-Rico, it invariably set from the Caribbean Sea to the North and N.N.E. On the western side of the Passage it set North, two miles an hour.

From *Trinidad*, westward, and off the North side of the Spanish Leeward Isles, the current has been found setting West and S.W. to the Gulf of Maracaybo; thence S.W., also to Cartagena: but it varies, as already described in pages 106 and 107.

From *Cartagena* towards the Channel of Yucatan, it has been found N.N.W., N.W., W.N.W., and N.W. by N., from 1 to nearly 2 miles, and then decreasing to $1\frac{1}{2}$ mile per hour. It has also been found setting to the eastward, as shown in the preceding pages.

At about 40 miles northward of *Cape Catoche*, the current has been found N.W. by W.; changing thence to S.S.W. off the N.W. point of Yucatan, nearly at the same distance from the coast. Rate something less than half a mile an hour. Between this and Vera Cruz the current ceases.

Three degrees to the N.N.E. of *Vera Cruz*, the current has been found setting to the N.E. one mile an hour. Thence N.N.E. and N. by E., and again N.E. nearly to the parallel of $25\frac{1}{2}^{\circ}$, longitude $91\frac{1}{2}^{\circ}$. Here it changed more to the East, and became, in latitude 26° E. by S., changing southward to S.E. by S. in the direction of the River Mississippi, and latitude $25^{\circ} 30'$ N. Hence it sets, with some variations, towards the western end of Cuba.†

7. THE FLORIDA OR GULF STREAM.

The current in the Gulf, from Vera Cruz to the meridian of the Mississippi, is noticed above. We have shown that it commonly sets S.E. by S. in the direction of the River Mississippi, and latitude $25^{\circ} 30'$. The current hence sets variously to the south-eastward. Its extent and exact direction are here unknown; but it is certain that, setting towards the N.W. of Cuba, and striking on the Banks of *Isabella* and *Colorados*, a portion of it winds round *Cape Antonio* to the south-eastward, while the great body of it sets eastward, to the northward of Cuba, winding to E.N.E., N.E., and North, through the Strait of Florida, and into the Atlantic Ocean, as shown on the Chart.‡

* On the leeward side of the Virgin Isles, devious currents are found, frequently to the south-eastward. The same have been observed on the western side of *St. Christopher's*, &c.

† Experience confutes the generally received notion, that the water circulates around the Gulf from Yucatan to Florida.

‡ At about $3\frac{1}{2}$ degrees North of *Cape Antonio* the current has, at times, been found setting to the S.W., winding towards the northern edge of the Yucatan Bank; but, at a degree thence eastward, setting nearly S.E. Off the West end of Cuba, at half a degree N.W. from *Cape St. Antonio*, it has been found setting S.W. by W. one mile an hour. But these cannot be considered as its general directions.

On the southern edge of the *Tortugas Soundings*, June 23 and 24, 1820, lat. $24^{\circ} 30'$, long. $83^{\circ} 30'$, Captain Monteath found the current setting E. by S. 20 miles in the 24 hours. Passing next day to lat. 24° , long. $82^{\circ} 20'$, it was found to have set E. by N. 42 miles.

The Stream, in mid-channel, on the meridian of Havanna, acquires the direction of E.N.E., and velocity of about $2\frac{1}{2}$ miles an hour. On the meridian of the southernmost point of Florida, its velocity, at about one-third over, from the Florida Reefs, is commonly 4 miles. Between the Bemini Isles and Cape Florida, its direction is about N. by E., and velocity more than 4 miles.*

On the Cuba side the stream is weak, and it sets to the eastward. On the opposite side, along the Florida Reefs and Kays, there is a reflow or counter-current, setting to the S.W. and West. By the assistance of the latter, many small vessels have navigated through the Strait from the northward; but this navigation is too dangerous to be attempted by strangers. The tides set among these reefs, as shown in the preceding division of this work.

The winds are found to affect the position of the stream considerably. Between Cuba and Florida, northerly winds press it southward towards the shore of the former; southerly winds have a contrary effect. When turned to the north, easterly winds press it to the Florida side, and westerly winds nearer to the Bahamas. Southerly winds cause it to spread, and so may those from the north.

In the Strait of Florida, within the Bahamas, when a northerly gale, increased to a storm, opposes the stream in its course, this adverse power causes it to fill all the channels and openings amongst the Martyr Isles and Reefs, and to overflow all the low coast. Shipping have even been carried over the low kays, and left dry on shore.† The water is supposed, at times, to have risen to the height of 30 feet; and to have been running, against the fury of the winds, at the rate of seven miles an hour. During these times, the Strait of Florida exhibits a scene terrific beyond description.

Besides the effect which different winds have upon the stream, it is subject to another power, that also directs it towards or from the coast; and that is, the moon; which, according to her position, has different effects upon it, not, however, in equal power with those of the wind; but the disposition of the stream is increased to its extreme, if the effect both of the wind and moon are combined; for, at this time, the ocean rising highest, this regulates the flood and ebb, and divides them in proportionate times; consequently it directs and increases them with an easterly moon and wind to the West, and with a westerly moon and wind to the East; so that the west and east shores are at times deprived of, and at other times overflowed by, tides, occasioned by these vicissitudes.

The boisterous East, N.E., and North, winds, which affect the Gulf-Stream, generally begin in September, and continue until March; when, if the moon happens just at the time to be on the full or change, they commonly end with a hurricane.

The stream, from latitude 26° to 28° , generally sets North, rather easterly; from 28° to about 31° , it appears to run North, inclining a little in the direction of the coast, rather westerly; it thence suddenly turns to N.E. by E., or a little more easterly, to latitude 35° , or about the parallel of Cape Hatteras.

The stream, instead of leaving the neighbourhood of the coast at Cape Hatteras, as formerly described, has been found to range up to the parallels of 38 and 39 degrees, running at the rate of about $2\frac{1}{2}$ knots: then the St. George's and Nantucket Banks appear to *front* it, and to throw it off to the E.N.E. and E. by N. northerly. In about the parallel of $39\frac{1}{2}^{\circ}$, longitude $63\frac{1}{2}^{\circ}$, it has been found to run at the rate of two knots between E. by N. and E.N.E.

* "The calculations of the velocity of the Gulf-Stream are not to be depended on. I have found it setting at the rate of five knots, and even upwards. This was on the 16th and 17th August, 1817. On the 19th and 20th February, 1819, it seemed to be imperceptible. In September, 1819, it set at much about the rate described in the Charts.

"An inspection of my Journal (see Appendix to this work) will show its effect on the ship Asia, in September, 1819, when bound from New Orleans to Gibraltar: also, that it had little influence in February, 1819, on the courses of the schooner Brilliant, after running over the Great Bahama Bank, until she made both the Double-Headed Shot Kay and the land of Cuba; and on those of the Dispatch, brig, of New Orleans, in March, 1819, from Havanna towards Barcelona."—*Andr. Livingston.*

† In the month of September, 1769, there happened an inundation, which covered the tops of the highest trees on the Cayo Larga, &c., and during which the Ledbury snow, John Lorain, master, was carried over the reef by the N.W. current of the stream, caused by a gale from N.E. The vessel bilged in shallow water, but an anchor was thrown out, and the next day the vessel was found to have grounded on Elliot's Kay, with its anchor among the trees.—*De Brahm's Atlantic Pilot.*

It has been stated, generally, by writers of ability, from the information of American coasters, that the northern edge of the Stream extends to the latitude of $41^{\circ} 20'$, or $41^{\circ} 30'$, on the meridian of the Isle of Sable: but this assertion has been controverted by others, who have averred that its northern edge never ascends beyond the parallel of 40° . The latter is certainly erroneous; for many instances prove the contrary. Colonel Williams, in his 'Thermometrical Navigation,' (Philadelphia, 1799,) states that, the whirlpools of the eddy, on the northern edge of the stream, have been seen in latitude $41^{\circ} 57'$, long. $65^{\circ} 1'$. He also observed great quantities of weed, supposed to be on the northern edge of the stream, in latitude $41^{\circ} 53'$, long. $65^{\circ} 33'$. It has subsequently been ascertained by Lieut. Chas. Hare, R. N. that, on the meridian of 57° W. in the summer season, (the rainy season of the West-Indies) the northern edge of the stream ranges up to $42\frac{1}{2}^{\circ}$ N.: and, even in the winter months, to above 42° N. This has been confirmed by twenty-five voyages to North-America, assisted by chronometer, thermometer, &c., the last of which was made in the fall of the year 1824.

It is, however, to be considered that, without the Strait of Florida, S.E., East, and N.E., winds force the stream towards the coast, contract its breadth, and thus increase its rapidity. On the contrary, S.W., West, and N.W., winds force the stream farther into the ocean, and diminishes its strength. It is clear, then, that, as the stream fluctuates in its direction and force, according to circumstances, no absolute rule can be given for ascertaining its boundaries.

The mean velocity of the stream, off Cape Hatteras, has been estimated at from 50 to 60 miles in the 24 hours.

In the northern regions of the stream, when the cold upon land is in winter most intense, which is generally between December and March, heavy and continued gales very frequently prevail, which commonly proceed from between the North and West, across the course of the stream, from Cape Hatteras until past George's Bank, and bend its direction to the eastward; being aided, at the same time, by the discharge of the great bays and rivers, increased by the force of the wind blowing down them, and the constant supply of stream that passes along the coast of the Carolinas, the whole produces so strong a current to the eastward, as to render it impossible for a ship to approach the coast until a change of wind commences.

During the prevalence of a southerly or easterly wind, which is not so common here, it has been found that the current is forced close to, and in some parts upon, the edge of soundings; being thus pent in between the wind and the shoal grounds near the shore, the breadth is greatly diminished, and the velocity proportionably increased. This circumstance has been, in particular, observed from about the longitude of Block Island, along the edge of the Nantucket Bank, thence beyond St. George's Bank; and, also, along the coasts of Georgia, and part of South Carolina. In the first instance, that the southerly winds forced the current to the edge of soundings, where it then ran from $1\frac{1}{2}$ to 2 knots; and, in the latter instance, that the easterly wind forced the current upon soundings. With West and N.W. winds, the stream would be removed some leagues farther off.

In its higher latitudes the Gulf-Stream varies, in its strength and direction; more than is commonly imagined. It has been found that, in one season of the year, as in February, it has been contracted to about half the breadth which it occupies in the advanced summer, and it is in these regions that additional observations on it are more particularly required.

From what has been said, it is clear that, the eddies about the edges of the stream must vary according to the circumstances above explained. Along these edges, but more particularly along the outer edge, there is generally a current running in a different direction, which it accelerated by the wind in proportion to its strength, blowing contrary to the stream, and retarded, or perhaps altogether obstructed, by the wind blowing in the direction of the stream. In the latter case, the limits of the stream will be extended.

The eddies on the inner edge are inconsiderable; but, on the outer one, in fine weather, they are strong, and of considerable extent.

REMARKS ON THE STREAM, by Capt. W. J. Monteath.—Between latitude $25^{\circ} 40'$ and $28^{\circ} 20'$ Captain Monteath found the current in the strait had set 80 miles in the 24 hours of June 27, 1820. On the southern border of the stream (northward of the parallel of

Cape Hatteras) 6th July, 1820, lat. $35^{\circ} 20'$ to $36^{\circ} 30'$, long. $72^{\circ} 30'$ to $71^{\circ} 3'$. Captain M. found the current setting N. 45° E. 75 miles in the 24 hours. Next day, July 7, to lat. $37^{\circ} 40'$, long. 69° , he found it N. 53° E. 86 miles in 24 hours. On the following day, July 8, to lat. $38^{\circ} 38'$, long. 67° it ran N. 58° E. 30 miles. July 9, to lat. $39^{\circ} 10'$, long. $66^{\circ} 10'$, westward only 10 miles. The observations were continued each day by chronometer, which agreed within a few miles.*

Here we may remark, both from the observations of Capt. Jn. Wilson and Lieut. Hare, that the Tail of the Grand Bank of Newfoundland does not extend, by more than a degree, so far to the southward as represented in former charts. In lat. 42° long. $49^{\circ} 50'$ no bottom can be found with 85 fathoms of line; and it does not appear that any soundings can now be found to the southward of $42^{\circ} 30'$ or $42^{\circ} 40'$ N.

REMARKS ON THE STREAM, &c. by Captain J. Steele Park.—We have given on a preceding page, (108) Captain Park's description of the north-westerly inset into the Gulf of Mexico, and his notice of the outset from the same. After rounding Cape Antonio, the land of Cuba was not seen. At this time, (the latter days of May, 1824) the stream along the Florida side, and even in the Strait, was by no means so strong as it is generally found. In the narrowest part, where, of course, we have a right to expect the greatest velocity, it was running at the rate of only $2\frac{1}{2}$ miles in the hour. This was correctly ascertained by meridian altitudes of sun and moon, and an excellent chronometer.

"When we cleared the Gulf," Captain Park adds, "I was anxious to keep in the influence of the stream, and pass near the Tail of the Bank of Newfoundland, but it came on to blow hard from the northward, in latitude $34^{\circ} 35'$ and long. $72^{\circ} 20'$ (E. by S. from Cape Hatteras.) This, of course drove us away to the eastward, out of the favorite track, and we passed about 300 miles to the northward of the Bermudas.† During this gale, for several days, a current was found to proceed from the eastward, to the W.S.W., but, in latitude 38° and long. about 59° the ship was in the Gulf-stream, setting finely to the N.E.

"On June 23d, at noon, lat. $37^{\circ} 51'$, long. $61^{\circ} 54'$; June 24, lat. $39^{\circ} 56'$ long. $57^{\circ} 26'$ (by altitudes and chronometer.) Here the ship really made $4^{\circ} 28'$ of easting in the 24 hours run, and the log gave only $3^{\circ} 16'$. In the same time much nothing was made. The true difference of latitude was 125 minutes, but the log gave about 80 only. The vessel had been running all the time E. by N. by compass, and went through the water 173 miles. Allowing half a point of variation, gives the true course N.E. by E. $\frac{1}{2}$ E. Subsequently, on making Scilly, there was not an error in the watch of a single mile.

"After the gale from the northward subsided, the winds became variable, between N.W. and S.W. The ship passed near the Tail of the Great Bank, and continued to carry a fine north-easterly current, at the rate of thirty, twenty-five, and twenty, miles a day, until she reached lat. $43^{\circ} 35'$ and long. $36^{\circ} 50'$, where it ceased."

* CURRENTS from the BAY of HONDURAS, and thence through the STRAIT of FLORIDA, as observed by Capt. W. J. Capes, in January, 1824.

Jan. 16 Lat. $17^{\circ} 55'$ Long. $87^{\circ} 30'$ Current 16 miles southerly in the 24 hours.

17	....	18	24	....	87	8	....	14 miles ditto.
18	....	18	14	....	86	35	....	16 miles ditto.
19	....	19	31	....	85	58	....	5 miles northward.
20	....	20	6	....	85	17	....	6 miles ditto.
21	....	20	47	....	85	39	....	5 miles ditto, and 20 eastward.
22	....	22	9	....	85	44	....	29 miles northward.
23	....	23	13	....	84	8	....	1 mile northward.
24	....	23	22	....	82	42	....	No current.
25	....	24	47	....	80	10	....	9 miles northward, and 55 eastward.
26	....	26	52	....	79	54	....	49 miles northward.
27	....	28	22	....	79	50	....	29 miles ditto.
28	....	30	0	....	78	34	....	37 miles ditto.
29	....	30	31	....	76	6	....	24 miles ditto.

† Already noticed in page 102.

OFF-SET FROM THE GULF-STREAM.

From the superior elevation of the Gulf-Stream, its water, about the Bahamas, appears to have a declivity or tendency to the eastward; and there is reason to believe that an off-set of the stream, from without the Maternillo Bank, sets, if not generally, very frequently, to the eastward and S.E. With the usual set of the currents, along the eastern range of the Bahama Islands, we are not accurately acquainted; but, with a N.W. wind, we have no doubt that it is in a S.E. direction. The Europa, a ship of war, returning to Jamaica, by this passage, from a cruise off Havanna, in 1787, steered East on the parallel of 30° N. with a westerly wind, until the run was supposed to have brought her on the meridian of Turk's Islands, by which it was intended to pass southward; but an easterly current had swept her along as high as that of the Mona Passage. Captain Manderson, of the Royal Navy, who first noticed this event, observes, "If it were once ascertained that a current was common in that part of the ocean, might it not be favourable for vessels bound from Jamaica to the Caribbee Islands, especially in the summer months, during the prevalence of the sea-breezes?"

Our respected friend, Captain Livingston, says, "I have no doubt there is a current, or rather off-set, from the Gulf-Stream to windward, between Bermuda and the Bahamas. In the Brilliant,* we found ourselves retarded very much in making westing when running for the Hole in the Wall, one day about 30 miles of longitude, by excellent observations, the truth of which was confirmed by our land-fall. In the Dispatch, we got out of the Gulf on the 13th March, 1819, when we were at noon, by observation, in latitude $28^{\circ} 0'$, longitude, by account, $79^{\circ} 12'$: on the 20th of March, at noon, we were, by meridian altitude, in lat. $29^{\circ} 48'$, and long. by acc. $72^{\circ} 32'$. Observations by sun and moon, a good lunar of three sights, altitudes and distances, and worked three times, gave $71^{\circ} 18' 30''$."

"In the schooner Young Dasher, January 1818, I spoke an American vessel, out five days from the Chesapeake, in latitude $24^{\circ} 40'$, or thereabout; my longitude by lunars was then about $69^{\circ} 50'$; his, by dead-reckoning, was $72^{\circ} 20'$. On the 11th of February, 1819, in latitude about $25^{\circ} 10'$ N., we spoke the schooner Hester, Captain Lawrence, out five days from Bermuda, bound to Jamaica; his longitude was $69^{\circ} 15'$, ours, by observation, $68^{\circ} 39'$."

"In the ship Fame, Capt. J. W. Monteath, a good lunarian, assured me that, he had been carried three degrees and upwards to the eastward, between the time of his departure from the American coast and making the Windward Passages: but this may have been partly occasioned by the Gulf-Stream, which he may have crossed too obliquely in proceeding from Norfolk." The Fame, above-mentioned, was bound from Norfolk, in Virginia, to Kingston, Jamaica, in May, 1816; and, in a run of thirteen days, until in the latitude of 29° and long. 61° , it was found that the current had set the vessel $3^{\circ} 10'$ E.

Captain Livingston adds, that "Captain Hall, in the brig Lowland Lass, passed to Windward of Porto-Rico, when he thought that he had run through the Mona Passage. Captain Patterson, of the brig Clyde, as I am informed, passed down the Anegada Passage, when he intended to have made the Mona. I have heard of two vessels' falling to leeward, but both were commanded by men whose names, as *seamen*, are not entitled to notice.

"In addition to the above notices, I have been assured, by an intelligent Spanish navigator, that, about thirty years since, vessels bound from Havanna to Europe used generally to cut off three degrees of longitude from their reckoning, on account of this set, which he said was considered then as certainly existing. At that time the Charts were about a degree wrong, which would reduce the Spaniard's allowance to two degrees, or thereby.

"These notices tend to prove that an easterly offset from the Gulf-Stream sets to the northward of the Bahamas: of this I am so firmly convinced, that if, in charge of a ship

* See Appendix, at the conclusion of this work.

from the Havanna, or even New Orleans, bound to Jamaica, I should, if allowed to follow my own plan, run out the Strait of Florida, and attempt making my passage with the aid of this off-set. This is to be understood, in case I should not have westerly winds in the southern parallels; for such winds are, I am told, more frequent than formerly; and I know that they are by no means of rare occurrence on the S.W. of Cuba."*

GULF-STREAM to St. GEORGE'S CHANNEL.—A bottle from the ship John Esdaile, H. King, commander, thrown into the sea 28th July, 1821, in lat. $36^{\circ} 55'$, long. $71^{\circ} 50'$, was picked up on the sand near the mouth of the Ribble, Lancashire, 5th Dec. 1822. It was, therefore, after leaving the stream set to the northeastward.

A vessel named the Two Sisters, was lost off the Coast of America, on the 1st of April, 1824, in latitude 30° N. Of this catastrophe notice was sent in a bottle, by Jas. Connell, which was picked up at Black Rock, near Dublin, 18th of July, 1824.

INDICATIONS OF THE GULF-STREAM.—The indications of the stream are the *appearance* and the *temperature of the water*. 1. The stream in its lower latitudes and usual course in fair water, where it flows uninterrupted, may be known by its smooth and clear blue surface; for, without the line formed by a ripple on its edge, the water, in some places, appears like boiling water of a blue colour; and, in other places, it foams like the waters of a cataract, even in dead calms, and in places which are fathomless.

On the outer edge of the stream, especially in fair weather, there are great rippings, which are very perceptible. The appearance of the sea-weed, by day, is an indication of this edge of the stream. This weed being, on the edge without the stream, in greater quantity and larger clusters than within it, as there the sprigs are small and few.†

It has been said that, the water within the stream does not sparkle in the night. We are assured by Captain Livingston, that, though this is a common, it is a misconceived, idea. "I have frequently seen it sparkle much; even last night it sparkled considerably, when we were in about 25° N. and 80° or $79^{\circ} 40'$ W.; and off Cape Roman, Cape Fear, Cape Hatteras, and the entrance of the Delaware, I have seen the water sparkle pretty much, though I think not equal to what it does in many other parts of the ocean."—*In the Stream*, 10th Sept. 1818. *A.L.*

The error, as to its not sparkling, has been shown, also, by Commissioner Ellicott, whose remarks are given hereafter.

* Captain Thomas Hamlin, in the brig *Recovery*, then in the Gulf-stream, was set to the northward 104 miles, in the 24 hours of the 20th March, 1820. The ship's place, at noon, $28^{\circ} 4'$ N. $79^{\circ} 50'$ W. To the north-eastward, on the next day, without the stream, in lat. $29^{\circ} 35'$, long. $77^{\circ} 25'$, the current was found to have set only 11 miles north, but considerably more to the eastward.

On the 16th February, 1818, the ship *Mars*, under the same commander, was at the back of the Matenillo Bank, and no northerly current was found: and nearly two degrees farther eastward, in $28^{\circ} 7'$ N. and $76^{\circ} 58'$ W. the current, in 24 hours, had set $3'$ S. and $14'$ E. The ship was, therefore, evidently in the off-set from the Gulf-stream.

In proceeding onward, towards Ireland, in March, Capt. Hamlin passed about four degrees to the northward of the Azores, and was favored by an easterly current from the parallel of $35\frac{1}{2}^{\circ}$, and meridian of 57° , until he reached the Saltees, on the S.E. coast, where his differences amounted to $3^{\circ} 36'$ E.

Captain Hamlin, in the *Recovery*, on his passage outward to Halifax, September, 1819, found the current westerly, from $45'$ to $30'$ per day, between the parallels of 51° and 46° , long. 29° to 37° . A gale from the 28th to the 30th Sept. disturbed the ship's course in about 43° N. and $41'$ W.; after which, to the eastward of the Newfoundland Bank, the current was found to set strongly to the eastward. The ship passed over the bank in the parallel of 43° ; the current still strong to the eastward; apparently the Gulf-stream. The *Recovery* thence proceeded to the southern edge of Banquereau, still finding a strong easterly current, but with diminished strength, which continued thence to the Bank of Sable Island.

The brig afterwards proceeded from Halifax to Jamaica; and, on the 22d Nov. 1819, in 40° N., 62° W., found a slight current to the southward; which, in the parallels of 26° to 23° , near the meridian of 64° , had changed to the eastward; but, on approaching the Silver Key Passage, a slight current to the westward appeared to prevail.

† Captain Bourke, in the ship Archibald, December 1815, found large quantities of this weed, commonly called *Gulf-weed*, near the parallel of 20° to the northward of the Island Porto-Rico, and of the eastern part of St. Domingo.

On the Archibald's Passage to the Havanna, through the Bahama Channel, eastward of the meridian of 70° , and on the North sides of St. Domingo and Cuba, none of the weed was seen.

The second and best indication of the stream is, *the temperature of its water*, which is considerably warmer than the water on either side of it. By an ingenious work, entitled "*THERMOMETRICAL NAVIGATION*," written by Colonel Jonathan Williams, and published at Philadelphia, in 1799, we are informed that, *Commodore Truxton*, of the American Marine, has often ascertained the velocity of the Gulf-Stream, to the northward of Cape Hatteras, and found it to be seldom less than one knot, and never more than two knots an hour. The temperature of the air and water without the stream was generally about the same; that is, the difference seldom exceeded 2 or 3 degrees; the air, being sometimes the warmest; at other times the water.*

This gentleman has observed, "In the stream the water is much warmer than the air; indeed, I have known it 10 degrees warmer; but, as soon as you get within the stream, (that is, between it and the coast,) the water becomes colder than the air; and the more as you get on soundings, and approach the shore.† If mariners, who have not the opportunity of determining their longitude by celestial observations, will only *carry with them a good thermometer*, and try the temperature of the water, and compare it with that of the air every two hours, they may always know when they come into, or go out of, the Gulf-Stream. Indeed, I have always made a practice, when at sea, of comparing the temperature of the air and water daily, and often very frequently, during the day, throughout my voyage; whereby I immediately discovered any thing of a current that way going, and afterwards found its strength and direction by observations for the latitude and longitude. It is of the utmost consequence, in making a passage to and from Europe, to be acquainted with this Gulf-Stream; as, by keeping in it, when bound eastward, you shorten your voyage; and, by avoiding it, when returning to the westward, you facilitate it inconceivably; so much so, that I have frequently, when bound from Europe to America, spoke European ships, unacquainted with the strength and extent of it, off the Banks of Newfoundland, and been in port a very considerable time before them, by keeping out of the stream; whereas they lengthened their passage, by keeping in it. The general course of the Gulf-stream being marked on the Chart, I would advise those who make the northern passage from Europe, never to come nearer the inner line of it, by choice, than 10 or 15 leagues; and then the probability will be, that their passage will be assisted by the help of a counter-current, which often runs within it. In coming off a voyage from the southward, be sure to steer N.W. when approaching the stream, if the wind will permit you; and continue that course until you are within it, which may be easily known by the temperature of the water, as before mentioned. I have always considered it of the utmost consequence, when bound in, to cross the

* "Notwithstanding what Commodore Truxton says, of its velocity of Cape Hatteras, in August, 1817, it set me, in the *Young Dasher*, one degree eight minutes, by sidereal and solar observation, to the northward of dead-reckoning, in sixteen hours; and Captain Israel Coltart, of Philadelphia, informed me, that it set, occasionally, with even greater rapidity." *A. Livingston.*

† "By the journals of Captain W. Billings, of Philadelphia, it appears that, in June, 1791, the water on the coast of America was at the temperature of 61°, and in the Gulf-Stream at 77°. By those of Mr. Williams, it appears that, in November, 1789, the water on the coast was 47°, and in the Gulf-Stream at 70°, viz:—

1791, June, Coast 61°	1789, November, Coast 47°	Difference between	Coast 14°
Stream 77	Stream 70	June and Nov.	Stream 7
Stream warmer 16	Stream warmer 23		

The difference of heat is, therefore, greater in winter than in summer. See the concluding observations, hereafter.

In the *America*, of 500 tons, Captain Heth, for Richmond, Virginia, 2d May, 1817. "After a series of baffling winds and boisterous weather, we find ourselves on the western, or in, side of the Gulf-Stream, and, of course, not far from our destination. Yesterday the temperature of the air was 65°, and of the water, 71°. To-day the air remains at 65°, but the water has fallen to 50°. We have, therefore, crossed this warm ocean river, which flows from the Gulf of Mexico."

'NOTES' of Maurice Birkbeck.

"On my voyage from Philadelphia to Kingston, Jamaica, on board of the schooner, *Young Dasher*, October, 1817, I particularly attended to the thermometer. Close off the Mouth of the Delaware, in about 16 fathoms, it stood at 60°; on the inner edge of the Gulf-Stream, it rose pretty rapidly to 66°; and, in the course of an hour, to 76°; next morning, 78°, which heat continued till we were to the southward of Bermuda; whence it gradually increased, until between Cuba, St. Domingo, and Jamaica, it was 82°, which appears to me to be the mean temperature of the sea-water about Jamaica."—*From memory*, 26th August, 1818.

Andrew Livingston. Google
stream

stream as speedily as possible, lest I should be visited by calms or adverse winds, and by those means drove far out of my way, which would prolong the voyage considerably, especially in the winter season."

By the advantage of knowing how near to the coast a ship may venture, and how to distinguish the Gulf-Stream from the water between it and the coast, we can be sure of a favourable current either way, and a small vessel might make a short voyage from Halifax to Georgia, which is thought by some a longer one than to Europe.—Suppose you had the wind a-head all the way; take your departure, and stand for the stream; so soon as you find the water to increase in heat, about half as much as you know it would when in the stream, heave about, and stand for the coast; you will infallibly discover the edge of soundings by the cooling of the water; then stand off again, and so on to the end of the voyage; when it is almost certain that the distance would be run in a shorter time than if there were no stream; for you would have a favourable inside or eddy-current. On the return passage, take your departure, and run off till you get into the warmest water, which will be the middle of the stream, and take the advantage of its current.

The following fact may serve to illustrate the propriety of these directions. In June, 1798, the mail-packet, for Charlestown, had twenty-five days passage in going, but returned in seven. The Captain accounted for this by having calms, or very light airs, and a northerly current. This was the true cause. He was in the middle of the stream, where there generally are calms or light winds; the edges, only, which come in contact with colder regions, being tempestuous. After being in the latitude of Cape Hatteras, he found himself in that of Cape Henry (37 leagues to the northward.) The vessel, however, arrived at last; and, on the return voyage, the Captain steered the same course back again, and with the same light airs he performed the voyage in seven days. Had this Captain known the use of the thermometer, need he to have been much longer in going than in coming?

It appears, also, by the work above quoted, that the thermometer is not only useful for ascertaining the current of the Gulf-Stream, but that it is likewise advantageous in discovering the approach to soundings from deep water.

In June, 1791, Captain W. Billings, of Philadelphia, in latitude 39 deg. longitude 56 deg. abreast of the Banks of Newfoundland, found that the mercury in the thermometer fell 10 degrees. It was near the same place that a similar observation was made by Dr. Franklin, in November, 1776; and another by Mr. Williams, in November, 1789, who has observed that, "By the coincidence of these three journals, at so great a distance of time, and without any connection with each other, this important fact seems to be established:—A NAVIGATOR MAY DISCOVER HIS APPROACH TOWARDS OBJECTS OF DANGER, WHEN HE IS AT SUCH A DISTANCE AS TO BE ABLE EASILY TO AVOID THEM, BY ATTENTIVELY EXAMINING THE TEMPERATURE OF THE SEA; the water over banks and shoals being colder, in general, than that of the deep ocean.

At the edge of the Grand Bank of Newfoundland, the water has been found 5 degrees colder than the deep ocean to the eastward. The highest part of the bank is 10 degrees colder still, or 15 degrees colder than the ocean eastward.

On the coast of New England, near Cape Cod,* the water, out of sounding, is 8 or 10 degrees warmer than in soundings; and, in the stream, it is about 8 degrees warmer still: so that, in coming from the eastward, a fall of 8 degrees will indicate your leaving the stream, and a farther fall of 8 degrees will indicate your being on soundings.

On the coast, from Cape Henlopen to Cape Henry, the water, out of soundings, is 5 degrees warmer than in soundings; and in the stream about 5 degrees warmer still; so that, in coming from the eastward, a fall of 5 degrees will indicate your leaving the stream, and a farther fall of 5 degrees will give notice of soundings.

* The bank from Cape Cod extends almost as far as Cape Sable, where it joins the banks of Nova Scotia, deepening gradually from 20 to 50 or 55 fathoms, which depth there is in latitude 43°. In crossing the bank between lat. 41° 41' and lat. 43°, the bottom is very remarkable; on the outside it is fine sand, shoaling gradually for several leagues; on the middle of the bank it is coarse sand or shingle, with pebble-stones; on the inside it is muddy, with pieces of shells, and deepens suddenly from 45 or 48 to 150 or 160 fathoms.

Colonel Williams recommends to seamen to take three thermometers. "Let them," he says, "be kept in one place some days previous to your sailing, in order to try their uniformity. The plate should be of ivory or metal, for wood will swell at sea, and, as the glass-tube will not yield, it is for this reason very liable to break; bell-metal is the best. Let the instrument be fixed in a square metal box, the bottom of which, as high as the mark 30 deg., should be water-tight, so that, in examining the degree of heat, the ball may be kept in the water; the remainder of the length should be open in front, with only two or three cross-bars to ward off any accidental blow, like the thermometer used by brewers. Fix one instrument in some part of the ship, in the shade, and in part of one of the after-stations, under the quarter-rail, may answer, if no better place can be found.

"Let the second instrument be neatly slung, with a sufficiency of line to allow it to tow in the dead water of the wake.

"Put the other away safely, to be ready to supply the place of either of the others, in case of accident."*

ADDITIONAL PARTICULARS, as given in a letter from Fras. D. Mason, Esq. to Colonel Williams, commandant of the corps of engineers, and author of "Thermometrical Navigation," at New York, dated

"Clifton, (Eng.) 20th June, 1810.

"My voyage from New York to Halifax, in the British packet *Eliza*, was so very tempestuous and unfortunate, (having carried away our foremast,) that I did not make any thermometrical observations; but, when we sailed from Halifax, on the 27th of April, I began them, and continued till I unfortunately broke both my thermometers. However short the time was, you will perceive that my observations have been very important, and I herewith send the result of them. You will perceive with what fidelity the thermometer indicated the banks and the approximation towards islands of ice. The Captain was so convinced of the usefulness of the thermometer, that he made regular remarks, and inserted them in his journal. I gave him one of your books, thinking it would be pleasing to you that I should extend the knowledge of a discovery so useful as yours, and I wish it were more generally known. After having miraculously escaped the islands of ice, and several severe gales, we arrived at Falmouth on the 22d of May, 1810."†

* A description of a newly-invented case for the thermometer, intended to ascertain the temperature of the sea, is given in the Appendix, hereafter.

† In a paper by Captain Livingston, on the utility of the thermometer, in approaching soundings, &c. inserted in the '*Edinburgh Philosophical Journal*,' vol. iii. 1820, Captain L. has said, "I am not aware that any experiments have been made to the northward of 43° 12', in which latitude the thermometers used by Mr. Mason, on board the *Eliza* packet, were unfortunately broken (see next page;) nor have I heard of any made to the southward of Cape Hatteras, anterior to those of which the results are recorded in the above-mentioned journal.

"My first experiments were made in October, 1817, on a voyage from Philadelphia to Kingston, in Jamaica. I began them inside the Capes of the Delaware, (i. e. in the Delaware Bay,) and continued them to Jamaica; but the journal of my voyage was lost on board a schooner, which upset in March, 1818. I well recollected, however, that, in the [water of the] bay, the mercury, in a Fahrenheit's thermometer, stood at 60° or 61°, about ten or twelve miles outside the capes, it rose to 66°, and afterwards, when we entered into the limits of the Gulf-Stream current, as it sweeps along the American shore, it rose to 78°, from which it did not vary until we passed to the southward of the parallel of Bermuda." See, farther, Appendix, hereafter.

It may be observed that, the latter part of the information, contained in this note, has been already given in a preceding one, page 116.

DATES.	Hours A.M.	Hours P.M.	Heat of Air Water		Latitude North	Longitude West	Remarks, on Sailing from Halifax to the S.E. and Eastward.
1810.			0	0	0	0	
April 28	10	..	44	40			
		1	47	41	43 30	62 52	
		4	43	42	....	....	Sable Bank.
		8	46	40			
— 29	8	..	45	43			
	Noon.		49	48	42 27	60 54	
		5	50	62			
		7	48	64			
		10	48	54	....	....	{ Tacking towards the edge of the stream.
— 30	9		58	62	....	....	Steering in the stream.
	Noon.		60	61	42 1	59 21	
		5	58	61			
		9	60	60			
May 1	8	..	60	58			
	11	..	60	46			
		2	64	45	41 53	56 52	
		3	62	46	....	....	{ An island of ice, bearing S.S.E. 7 miles.
		4	58	47	....	....	{ Abreast of ice one quarter of a mile to leeward.
		5	60	47	....	....	Island of ice bears S.S.W. 7 miles.
		6	57	45			
		8	56	48			
— 2	1	..	58	50			
	3	..	60	60			
	8	..	60	62			
	10	..	63	63			
	Noon.		64	63	41 25	53 8	
		3	61	64			
		6	62	58			
		9	56	56			
— 3		12	50	56	....	....	{ Sound with 80 fathoms, no bottom.
	4	..	43	43	....	....	{ Sound with 80 fathoms, no bottom.
	6	..	40	39	....	....	{ An enormous island of ice a- breast, about 100 yards dis- tant.*
	8	..	41	44	....	....	{ Passed several islands of ice, the largest bearing S.W. 7 miles.
	10	..	43	45			
	Noon.		44	43	42 1	50 4	No bottom by 80 fathoms.
		4	44	50			
		6	46	60			
	Midn.	12	46	60			
— 4	4	..	46	52			
	8	..	43	60			
	Noon.		54	59	42 54	46 2	
		8	49	60			
		12	48	60			
	6	..	47	59			
	Noon.		53	59	43 12	41 43	Broke the thermometers.

* This was about 150 feet high, and one mile in diameter. When first discovered, it was not 100 yards from the vessel, and we were sailing directly towards it. The obscurity was then so great, that, at that distance, it appeared only like a white cloud, extending from the sea over our masts.

REMARKS, CONNECTED WITH THE ELIZA'S JOURNAL, BY COLONEL WILLIAMS.

“ The important point of comparison is the difference in the *heat of the water in different places*, in or near the stream, in the ocean, out of the stream, on the coast, and near islands of ice; not the difference between the heat of the water and the air, as some have imagined. This latter is merely a concurrent observation; as it serves to account for ordinary changes, and thereby to guide the judgment.

“ From April 28, at 10 *a.m.* to April 29, at 8 *a.m.* we see the temperature of the sea on the shoals of Sable, from 40 to 43. At 5 *p.m.* we see the warm influence of the Gulf-Stream from 62 to 64. At 10 *p.m.* we see the temperature between the influence of the stream in deep water and the coast, at 54°, which is about a mean between the two; then standing off shore, at 9 the next morning, 30th, we see the warm influence of the stream again.

“ If these stripes of water had been distinguished by the colours of white, red, and blue, could they be more distinctly discoverable than they are by the constant use of the thermometer?

“ About 23 hours afterwards, (May 1st, at 8 *a.m.*) we find the water cooling; and, in three hours more, the mercury falls 14 degrees (46°.) Here no bottom could be found by the lead, and there was probably an island of ice obscured by fog. (Let it be remembered that the coldness of ice condenses the atmosphere, and of course the consequence must be fog.) Passing this at two *p.m.* the thermometer rose to 54°, but in one hour more it fell to 46° again, and an island of ice appeared at the distance of *seven miles*. Let navigators reflect on this, and say that a sudden fall of six degrees, in this part of the ocean, ought to induce them to haul to the southward, and keep a good lookout. From May 1, at 11 *a.m.*, to the next morning at one *a.m.* we see the gradual changes as the ship passes the ice, and comes again into ocean water (50°); but, in two hours more, the ship is in the warm influence of the stream again, and the mercury rises 10 degrees (60°.) She proceeds in a nearly regular degree of heat during 17 hours; till, at 6 *p.m.* the water begins again to cool, falling to 56° at midnight. Here was no bottom at 80 fathoms. May 3, at 4 *a.m.* the water was at 43°, still no bottom in 80 fathoms. Now, from past experience, we must say, here is an island of ice in a less distance than seven miles, because at that distance the water was 46°. When day appears, behold an enormous island of ice, 100 yards a-breast, and the heat of the water reduced to 39°! A question now occurs,—Had not the thermometer been thus used, had it not been continued during the night, what would have been the fate of this ship? Let the recollection of the miserable fate of the ship *Jupiter** be an impressive answer; and let it be laid down as a maritime axiom, that want of caution, or ignorance, alone, can cause such accidents in future.

(Signed)

“ JONA. WILLIAMS.”

To the foregoing observations the Editor has now the satisfaction of adding, from the obliging information of Mr. Rowland Bourke, commander of the ship *Archibald*, from the Havanna to London, 1816, that he had made experiments on the temperature of the water, which verified the principle developed by Colonel Williams. These experiments were made on leaving the Gulf-Stream, and on approaching soundings upon the tail of

* The Captain's protest, containing the particulars of the distressing circumstance of the ship *Jupiter*, states,

“ April 6, in latitude 44° 20', longitude 49°, at 8 *a.m.* several pieces of broken ice, from which, at 11 the same day, we supposed ourselves entirely clear, and steering W. by N., West, E.N.E. and foggy weather. At two *p.m.* began to discover islands of ice again, and, at 3 o'clock, saw a large field a-head, which appeared to have no opening. We then wore ship, and kept off to the southward and eastward; continually passing small islands of ice, until 5 *p.m.*, when we found the ice extending so far to north and south, that we could not clear it. We then hove about, and stretched to the northward, among the broken ice, till night came on, and no prospect of getting clear. We hove-to under the three topsails double-reefed, in hopes to have sufficient drift to keep clear of the fields of ice to leeward until day-light; but found, at about 11, we were drifting fast upon a large field, and were obliged to wear ship, and haul to the southward under easy sail, luffing and bearing away from the broken ice as occasion required, until half-past twelve, when we struck a small-piece, which went through the starboard bow.”

the Newfoundland Bank. Captain Bourke had been perusing a former edition of the present work; and, having accidentally a thermometer on board, "he thought," to use his own words, "that he might as well try, by the temperature of a few buckets of water, whether it answered or not." The particular results were not committed to paper; but, in one instance, the Captain recollects a difference of seven degrees in the temperature of the water, within the space of a short time, when leaving the stream: subsequently a fall of several degrees announced the ship's approach to the bank. In brief, the whole accorded with the preceding explanation, and proved the great utility of an instrument, with which, in these respects, many seamen are yet unacquainted.

REFLOWING CURRENTS, &c.—On each side of the Gulf-Stream, as before noticed, there is a counter-current setting in a different or contrary direction. In the Strait of Florida, between the stream and the coast, a smooth eddy commonly takes its current, south-westerly, in an opposite direction to that of the main stream; and there is, even in its higher latitudes, a reflow on either side.

Again, to the northward of Cape Canaveral, along the southern coast of the United States, you will find no tide farther out from the shore than in 10 or 12 fathoms of water; from that depth to the edge of soundings you will have a current setting to the southward, at the rate of one mile per hour; when out of soundings, you will have the Gulf-Stream setting to the northward.

It has been found that, when Cape Henry (the South point of the Chesapeake) bore N.W. 160 leagues distant, a current was setting to the southward at the rate of 10 or 12 miles per day, which so continued until Cape Henry bore W.N.W. 89 or 90 leagues; the current was then found setting to the N.E. at the rate of 33 or 34 miles per day, which continued until within 32 or 30 leagues of the land; then a current set to the southward and westward at the rate of 10 or 15 miles per day, to within 12 or 15 miles of the land. This current, which is considered as the eddy of the Gulf-Stream, sets more or less to the S.W., according to the figure of the coast.

It has also been observed, by others, that a southern and western current constantly sets in higher latitudes between the Gulf-Stream and coast; more particularly in soundings, at the rate of half a mile an hour, or more, according to the wind.

An experienced officer of the Royal Navy, before quoted, has said that, "In all the observations I made during the five years cruising on the American coast, I never found the eastern or Gulf current to the southward of latitude 36° , and only once so far; and I have often, about the latitude of 36° or 37° , and between the longitudes of 60° and 69° , found a strong current to the South or S.W." Therefore, ships from Europe, bound to America, should endeavour to make their passage either to the southward of latitude 37° , or to the northward of the latitudes already given; that is to say, when as far to the westward as the Banks of Newfoundland, they should, as much as possible, avoid beating against the wind to the westward, between the latitudes of 37 and 42 degrees. (See page 112.)

Upon soundings, along the coasts of Georgia, Carolina, Virginia, New Jersey, and New York, the current runs in general parallel to the shore; and is commonly influenced by the wind, which mostly prevails from between the South and West, producing a slow current of about one or a half mile to the N.E.; but, when the North and East winds prevail, the current along shore to the S.W. will frequently run two miles; on which the pilots of this coast remark, that the South and S.W. currents, though they but seldom happen, yet they are always stronger than those to the northward, which are more frequent. It is probable the tides may have some influence on these currents, particularly near the entry of the great bays and inlets. The flood on this coast comes from the N.E. In the months of April and May, I have observed, on crossing the Gulf-Stream, in the latitude of Cape Henry, that, when near the inside of the stream, the water begins to colour of a deeper green: and thence to the edge of soundings there is a strong current to the eastward. The colour of the water, from green, turns to muddy, when on soundings, the current still continuing until within the influence of the tide: this eastern current is, no doubt, occasioned by the discharge of water out of the Chesapeake, by the floods, from the snow melting in the country; and it prevails, in some degree, throughout the year, but its effect is greatest at this time. It is probable that a similar current prevails off the mouth of the Delaware.

Round the East end of Long Island, and thence, to the eastward, round Nantucket Shoals, across George's Bank, to Cape Sable, a strong tide runs; the flood setting to the North and West, in order to fill up the bays, rivers, and inlets, and the ebb the contrary. The tides that set across George's Bank into the Bay of Fundy are very much influenced by the winds, particularly if, after a strong S. or S.E. wind, it should suddenly change to W. or N.W. (circumstances that often happen); ships will then find themselves drifted by the outset 50 or 60 miles in the 24 hours, or more to the S.E. The indraught is also great with S. or S.E. winds, which ought to be paid particular attention to.

Upon the Nova-Scotia coast the currents run parallel to the shore, but are more frequent from the eastward than from the westward, particularly in the spring; the southerly winds force them upon shore by the water running in to fill up the bays and inlets; and the N. and N.W. winds have the same effect in forcing them off the shore. A regular tide here runs along shore; the flood from E.N.E.

OBSERVATIONS ON THE GULF-STREAM, &c. by SIR CHARLES BLAGDEN, M.D. and F.R.S., extracted from the PHILOSOPHICAL TRANSACTIONS.

"During a voyage to America, in the spring of the year 1776, I used frequently to examine the heat of sea-water, newly drawn, in order to compare it with that of the air. We made our passage far to the southward. In this situation, the greatest heat of the water, which I observed, was such as raised the quicksilver, in Fahrenheit's thermometer to $77\frac{1}{2}^{\circ}$. This happened twice; the first time on the 10th of April, in latitude $21^{\circ} 10' N.$, and longitude, by our reckoning, $52^{\circ} W.$; and the second time, three days afterwards, in latitude $22^{\circ} 7'$, and longitude 55° ; but, in general, the heat of the sea, near the tropic of Cancer, about the middle of April, was from 76 to 77 degrees.

"The rendezvous appointed for the fleet being off Cape Fear, our course, on approaching the American coast, became north-westward. On the 23d* of April, the heat of the sea was 74° , our latitude, at noon, $28^{\circ} 7' N.$ Next day the heat was only 71° ; we were then in latitude $29^{\circ} 12'$; the heat of the water, therefore, was now lessening very fast, in proportion to the change of latitude. The 25th, our latitude was $31^{\circ} 3'$; but though we had thus gone almost 2 degrees farther to the northward, the heat of the sea was this day increased, it being 72° in the morning, and $72\frac{1}{2}^{\circ}$ in the evening. Next day, the 26th of April, at half-after eight in the morning, I again plunged the thermometer into sea-water, and was greatly surprised to see the quicksilver rise to 78° , and higher than I had ever observed it, even within the tropic. As the difference was too great to be imputed to any accidental variation, I immediately conceived that we must have come into the Gulf-Stream, the water of which still retained great part of the heat that it had acquired in the torrid zone. This idea was confirmed by the subsequent regular and quick diminution of the heat: the ship's run for a quarter of an hour had lessened it 2 degrees: the thermometer, at three-quarters after eight, being raised, by sea-water fresh drawn, only to 76° ; by nine the heat was reduced to 73° ; and, in a quarter of an hour more, to 71° nearly: all this time the wind blew fresh, and we were going seven knots an hour on a north-western course. The water now began to lose the fine transparent blue colour of the ocean, and to assume something of a greenish olive tinge, a well-known indication of soundings. Accordingly, between four and five in the afternoon, ground was struck with the lead, at the depth of eighty fathoms, the heat of the sea being then reduced to 69 degrees. In the course of the following night and next day, as we came into shallower water and nearer the land, the temperature of the sea gradually sank to 65° , which was nearly that of the air at the time.

"Unfortunately, bad weather, on the 26th, prevented us from taking an observation of the sun; but, on the 27th, though it was then cloudy at noon, we calculated the latitude from two altitudes, and found it to be $33^{\circ} 26' N.$ The difference of this latitude from that which we had observed on the 25th, being $2^{\circ} 23'$, was so much greater than could be deduced from the ship's run, marked in the log-book, as to convince the seamen that we had been set many miles to the northward by the current.

* From the difference between civil and astronomical time, it becomes necessary to observe, that the former is always meant in this paper.

" On the 25th, at noon, the longitude, by our reckoning, was 74 degrees W. ; and I believe the computation to have been pretty just ; but the soundings, together with the latitude, will determine the spot where these observations were made, better than any reckoning from the eastward. The ship's run, on the 26th, from nine in the forenoon to four in the afternoon, was about 10 leagues on a N.W. by N. course ; soon afterwards we hove-to in order to sound, and, finding bottom, we went very slowly all night, and till noon the next day.

" From these observations, I think, it may be concluded, that the Gulf-Stream, about the 33d degree of north latitude, and the 76th degree of longitude west of Greenwich, is, in the month of April, at least six degrees hotter than the water of the sea through which it runs. As the heat of the sea-water evidently began to increase in the evening of the 25th ; and, as the observations show that we were getting out of the current when I first tried the heat in the morning of the 26th, it is most probable that the ship's run, during the night, is nearly the breadth of the stream, measured obliquely across ; that, as it blew a fresh breeze, could not be less than 25 leagues in 15 hours, the distance of time between the two observations of the heat, and hence, the breadth of the stream may be estimated at 20 leagues. The breadth of the Gulf of Florida, which evidently bounds the stream at its origin, appears to be 2 or 3 miles less than this, excluding the rocks and sand-banks which surround the Bahama Islands, and the shallow water that extends to a considerable distance from the coast of Florida ; and the correspondence of these measures is very remarkable, since the stream, from well-known principles of hydraulics, must gradually become wider as it gets to a greater distance from the channel by which it issues.*

" If the heat of the Gulf of Mexico were known, many curious calculations might be formed, by comparing it with that of the current. The mean heat of Spanish Town, and Kingston, in Jamaica, seems not to exceed 81 degrees ; † that of St. Domingo, on the sea-coast, may be estimated at the same, from Mons. Godin's observations ; ‡ but, as the coast of the continent, which bounds the Gulf to the westward and southward, is probably warmer, perhaps a degree or two may be allowed for the mean temperature of the climate over the whole bay : let it be stated at 82 or 83 degrees. Now there seems to be a great probability in the supposition, that the sea, at a certain comparatively small distance below its surface, agrees in heat pretty nearly with the average temperature of the air during the whole year in that part ; and hence it may be conjectured, that, the greatest heat of the water, as it issues out of the bay to form the stream, is about 82°, § the small variations of temperature on the surface not being sufficient to affect materially that of the general mass. At the tropic of cancer, I found the heat to be 77° ; the stream, therefore, in its whole course from the Gulf of Florida, may be supposed to have been constantly running through water from 4 to 6 degrees colder than itself, and yet it had lost only 4 degrees of heat, though the surrounding water, where I observed it, was 10° below the supposed original temperature of the water which forms the current. From this small diminution of the heat, in a distance, probably, of 300

* Since Sir Charles Blagden wrote on the subject, the narrowest part of the Strait of Florida has been found to be only 13 leagues in breadth. With regard to the heat of the water in the Gulf of Mexico, see Captain Livingston's Journal, in the Appendix, hereafter.—ED.

† History of Jamaica, London, 1774, vol. iii. p. 652, 653. The different observations of the heat recorded in that work do not agree together ; but those adopted here are taken from that series which appear to me the most correct.

‡ Monsieur Godin's experiments upon the pendulum were made at the Petit-Goave. They continued from the 24th of August to the 4th of September, and the average heat during that time was such as is indicated by 25 deg. of M. de Reaumur's thermometer, (see Mem. Acad. Science, 1735, p. 517,) according to M. de Luc's calculation, (see Modifications de l'Atmosphere, vol. 1, p. 378,) the 25th degree of Reaumur's true thermometer answers to about the 85th of Fahrenheit's ; but the average heat in Jamaica, during the months of August and September, is also 85 deg. ; hence we may conclude, that, the mean heat for the whole year is nearly the same on the sea-coasts of both islands.

§ The lowest calculation of the mean temperature of the Gulf is preferred on this occasion, because of the constant influx of new water from the Atlantic Ocean, produced by the trade-winds ; which water, not having been near any land, must, I think, be sensibly colder than that which has remained some time inclosed in the bay. On this subject, the observations made by Alexander Dalrymple, Esq., relative to the heat of the sea near the coast of Guinea, ought to be consulted. (See Phil. Trans. vol. 68, p. 394, &c.)

miles, some idea may be acquired of the vast body of fluid, which sets out from the Gulf of Mexico, and of the great velocity of its motion. Numerous observations on the temperature of this stream, in every part of it, and at different seasons of the year, compared with the heat of the water in the surrounding seas, both within and without the tropic, would, I apprehend, be the best means of ascertaining its nature, and determining every material circumstance of its movement, especially if the effect of the current, in pushing ships to the northward, is carefully attended to, at the same time with the observations upon its heat."

On the 25th of September, 1777, as the ships which had transported Sir William Howe's army up Chesapeake Bay were returning towards the Delaware with the sick and stores, they were overtaken, between Cape Charles and Cape Henlopen, by a violent gale of wind, which, after some variation, fixed ultimately at N.N.E., and continued five days without intermission. It blew so hard that we were constantly losing ground, and driving to the southward: we also, purposely, made some *easting*, to keep clear of the dangerous shoals which lie off Cape Hatteras.

On the 28th, at noon, our latitude was $36^{\circ} 40' N.$, and the heat of the sea, all day, about 65 degrees. On the 29th, our latitude was $36^{\circ} 2'$; we had, therefore, in the course of these 24 hours, been driven by the wind 38 nautical miles to the southward: the temperature of the sea continued nearly at 65° . Next day, the 30th, our latitude, at noon, was $35^{\circ} 41'$, only 18 miles farther to the southward, though, in the opinion of the seamen aboard, as well as my own, it had blown at least as hard on this as on any of the preceding days, and we had not been able to carry more sail; consequently, it may be concluded that, some current had set the ship 20 miles to the northward. To know whether this was the Gulf-Stream, let us consult the thermometer. At half-after nine in the forenoon of this day, the heat of the water was 76° , no less than 11 degrees above the temperature of the sea before we came into the current!

Towards evening the wind fell, and we stood N.W. by N. close-hauled. As the sea still ran very high, and the ship scarcely went above two knots an hour, we did not make less than three points of leeway on this tack; the course we made good, therefore, was W.N.W., which, on the distance run by noon next day, gave us about 16 miles of *northing*; but that day, the 1st of October, our latitude was $36^{\circ} 22'$, 38 miles farther to the north than we had been the day before; the difference, 22 miles, must be attributed to the Gulf-Stream. This, however, is only part of the effect which the current would have produced upon the ship, if we had continued in it the whole four-and-twenty hours; for, though we were still in the stream at five o'clock in the afternoon of the 30th, as appeared by the heat of the water, being then above 75° ; and, at eight in the evening, the heat being still 74° , yet, by seven the next morning, we had certainly got clear of it, the heat of the sea being then reduced to its former standard of 65° . On this occasion, therefore, we did not cross the stream; but, having fallen in with it obliquely on the western side, we pushed out again on the same side, as soon as the gale abated.

These observations having been made three degrees to the northward of my former ones, it is curious to observe, that the heat of the Gulf-Stream was 2 degrees less. The seasons of the year, indeed, were very different: but, perhaps, under such circumstances that their effects were nearly balanced. In the latter observations, the meridian altitude of the sun was less; but then a hot summer preceded them; whereas, in the former, though the sun's power was become very great, yet the winter had been past but a short time. Calculating upon this proportion, we may be led to suspect, that, about the 27th degree of latitude, which is as soon as the stream has got clear of the Gulf of Florida, it begins sensibly to lose its heat from 82° , the supposed temperature of the Gulf of Mexico, and continues to lose it at the rate of about 2 degrees of Fahrenheit's scale to every 3 degrees of latitude, with some variation, probably as the surrounding sea and the air are warmer and colder at different seasons of the year.

The preceding facts had made me very desirous of observing the heat of the Gulf-Stream on my passage homeward; but a violent gale of wind, which came on two days after we had sailed from Sandy Hook, disabled every person on board, who knew how to handle a thermometer, from keeping the deck. The master of the ship, how-

ever, an intelligent man, to whom I had communicated my views, assured me, that, on the second day of the gale, the water felt to him remarkably warm; we were then near the 70th degree of west longitude. This agrees very well with the common remark of seamen, who allege, that they are frequently sensible of the Gulf-Stream off Nantucket Shoals, a distance of more than 1000 miles from the Gulf of Florida! According to the calculation I have before adopted, of a loss of 2 degrees of heat for every 3 degrees of latitude, the temperature of the Gulf-Stream here would be nearly 73° ; the difference of which, from 59° , the heat that I observed in the sea-water, both before and after the gale, might easily be perceived by the master of the vessel. This was in the winter-season, at the end of December.

An opinion prevails among seamen, that there is something peculiar in the weather about the Gulf-Stream. So far as I could judge, the heat of the air was considerably increased by it, as might be expected; but whether to a degree or extent sufficient for producing any material changes in the atmosphere, must be determined by future observations.

Perhaps other currents may be found, which, issuing from places warmer or colder than the surrounding sea, differ from it in their temperature so much as to be discovered by the thermometer. Should there be many such, this instrument will come to be ranked among the most valuable at sea; as the difficulty of ascertaining currents is well known to be one of the greatest defects in the present art of navigation.

In the mean time, I hope the observations which have been here related are sufficient to prove, that, in crossing the Gulf-Stream, very essential advantages may be derived from the use of the thermometer; for, if the master of a ship, bound to any of the southern provinces of North-America, will be careful to try the heat of the sea frequently, he must discover very accurately his entrance into the Gulf-Stream, by the sudden increase of the heat; and a continuance of the same experiment will show him, with equal exactness, how long he remains in it. Hence he will always be able to make a proper allowance for the number of miles that the ship is set to the northward, by multiplying the time into the velocity of the current. Though this velocity is hitherto very imperfectly known, from want of some method of determining how long the current acted upon the ships, yet all uncertainty arising from thence must soon cease, as a few experiments upon the heat of the stream, compared with the ship's run, checked by observations of the latitude, will ascertain its motion with sufficient precision. From differences in the wind, and perhaps other circumstances, it is probable, that, there may be some variations in the velocity of the current; and it will be curious to observe, whether these variations may not frequently be pointed out by a difference in its temperature; as the quicker the current moves, the less heat is likely to be lost, and, consequently, the hotter will the water be. In this observation, however, the season of the year must always be considered; partly, because it may, perhaps, in some degree, affect the original temperature of the water in the Gulf of Mexico: but, principally, because the actual heat of the stream must be greater or less in proportion as the tract of the sea, through which it has flown was warmer or colder. In winter, I should suppose, that the heat of the stream itself would be rather less than in summer; but that the difference between it and the surrounding sea would be much greater; and, I conceive that, in the middle of summer, though the stream had lost very little of its original heat, yet the sea might, in some parts, acquire so nearly the same temperature, as to render it scarcely possible to distinguish by the thermometer when a ship entered into the current.

Besides the convenience of correcting a ship's course, by knowing how to make a proper allowance for the distance she is set to the northward by the current, a method of determining with certainty when she enters into the Gulf-Stream is attended with the farther inestimable advantages of shewing her place upon the ocean in the most critical situation: for, as the current sets along the Coast of America, at no great distance from soundings, the mariner, when he finds this sudden increase of heat in the sea, will be warned of his approach to the coast, and will thus have timely notice to take the necessary precautions for the safety of his vessel. As the course of the Gulf-Stream comes to be more accurately known, from repeated observations of the heat and latitudes, this method of determining the ship's place will be proportionably more applicable to use. And it derives additional importance from the peculiar circumstances of the American coast, which, from the mouth of the Delaware to the southernmost point of Florida, is every where

low, and beset with frequent shoals, running out so far into the sea, that a vessel may be aground in many places where the shore is not to be distinguished even from the mast-head. The Gulf-Stream, therefore, which has hitherto served only to increase the perplexities of seamen, will now, if these observations are found to be just in practice, become one of the chief means of their preservation upon that dangerous coast.

REMARKS ON THE GULF-STREAM, BY COMMISSIONER ELLICOTT.

We shall conclude this division with some corroborative and additional remarks, from the pen of an eminent and scientific citizen of the United States, Commissioner Andrew Ellicott. This gentleman, in allusion to the difference of temperature in the water, says, "This difference of temperature arises from the water in the Stream's remaining a considerable time nearer the equator, and then flowing with rapidity into a colder climate; and though, as it proceeds northward, it continues to lose its heat, it is, nevertheless, passing through water which still becomes colder as it advances north, so that the relative difference continues nearly the same for a great distance. The difference which I generally found, between the water in the stream, and the eddy water on the coast, was about 7 degrees.

"It has been supposed, by some ingenious writers, that, because after leaving the stream, and having soundings on our coast, and a diminution in the heat of the water, about the same time, it followed, of course, that the water on soundings, and banks, is always colder than the water adjoining. Though this may constantly be the case on our coast, it is probable the conclusion ought to be considered as a *particular, and not a general, one*. On our coast the stream passes nearly along the great bank of soundings; it is, therefore, very natural to suppose that, soon after leaving the Stream, you will have soundings, and be in one of the large eddies on the coast, whose waters, being nearly stationary, are therefore colder than that moving with rapidity from the southward. Again, it may be observed that, the adjoining water in the Atlantic, without the Stream, is also colder, as well as that on soundings; but, on the contrary, fathomless. Hence the difference in this case does not appear to depend upon the depth of the water, but upon a current setting rapidly from a warmer into a colder climate. From this a conclusion may very fairly be drawn, that, *the sudden changes found in the temperature of the water in the Ocean are more immediately the effect of CURRENTS, than of BANKS and SOUNDINGS*; but, as these currents are generally near coasts, and frequently occasioned by them, the thermometer may be considered a good monitor.

"It has been mentioned by Dr. Franklin, that the water of the Gulf-Stream *does not sparkle in the night*. This, so far as my observations go, is incorrect: I saw little or no difference between that and the other water on the coast; but, if there was any, that of the Gulf-Stream was the most sparkling and luminous. It may, however, be observed that, the same water is very different, at different times, in this respect.

"The same ingenious writer and philosopher likewise observes, that the Gulf-weed is a sign of being in the Stream. This is, in part, true, but by no means to be considered as a general rule, because *the water on the borders of the Stream is constantly mixing with the adjoining water, and leaving some of the weed behind, which consequently falls into the eddy currents, and is carried off many leagues*. We meet with it on soundings, in the eddy current, setting southerly. These remarks cannot affect the character of Dr. Franklin, either as a writer or philosopher; his character is formed of materials which will elude the destroying hand of time itself, and will be revered so long as liberty and science command the affections and esteem of mankind. I merely think the Doctor was mistaken, and conceive it to be my duty to state facts."

The Description of, and Directions for Sailing through, the Gulf-Stream, from the Spanish Directory, entitled, '*Derrotero de las Antillas*,' will be found hereafter, in the Directions for Ships bound to and from the West-Indies.

* "Journal of Andrew Ellicott, late Commissioner on behalf of the United States, for determining the Boundary between the United States and the Spanish Possessions."—Quarto, Philadelphia, 1803.

8. THE ST. LAWRENCE STREAM, &c.

We have shown, in a former division of this compilation on the existing Currents, (page 92) how they set from Hudson's Strait to the Eastern Coast of Newfoundland, and through the Strait of Belle-Isle into the Gulf of St. Lawrence. Thus it may be seen that they also affect the western navigation of the island. Added to this, is the water brought down by the vast ebb of the River of St. Lawrence, which constantly sets down, with great strength, into the Gulf, as shown in the Remarks on tides, page 79. Thus is the Gulf supplied with water, which can escape by the southward only. In the early part of the year, when the snows and ices are in a melting state, the outset must be considerably increased; it may, therefore, be presumed, that there is, in this season, a considerable efflux or stream of water from the Gulf, setting to the south, S.W., and south-eastward.

Captain Pornton, a commander, who has long sailed in the Newfoundland trade, states that the branch of current, which appears to come from Hudson's Bay, always sets to the south-westward, on the eastern coast of Newfoundland: sometimes with a velocity of two miles an hour. Its strength, however, varies, with the direction and force of the wind. Passing down the eastern coast of Newfoundland, it turns round Cape Race, and sets thence along the south side of the island until it meets with the current from the St. Lawrence, a little to the westward of St. Peter's and Miquelon Islands. The combined action of these two currents, with that of the Stream to the southward, may, perhaps, produce that *counter current* which has been found along the inner edge of the Gulf-Stream: But, be this as it may, it is very probable that it is owing to the influence of the Hudson's Bay current that so many shipwrecks happen on the south coast of Newfoundland, about Cape Pine, &c. For ships coming from the St. Lawrence and thence along the coast of Newfoundland, meet this current; and, if it happen that they have calms, or light or head winds, it sets them imperceptibly to the westward of their reckoning: and when, supposing that they are to the eastward of Cape Race, they alter their course more to the northward, should the weather, as it often is, be foggy, they get on shore at a time when they consider themselves clear of the land.*

At times, it seems, the westerly current may extend farther than the limit above described. In a letter from a captain of the Royal Navy, dated *Bretón Island*, 13th May, 1822, we have the following expressions:—"It frequently happens that a ship bound from England to Quebec, strikes soundings on the Banks of Newfoundland, and shapes her course thence to pass between Cape North, on Breton Island, and Cape Ray, on Newfoundland, into the Gulf of St. Lawrence, without seeing the land, which is hid in fog; and, unable to make a proper allowance for a current that sometimes runs at the rate of *four miles an hour*, is swept away to the westward, and runs, with a leading wind, on our iron-bound shores, when her commander fancies he is steering directly into the gulf; a misfortune that is too often announced by the bodies of the unhappy mariners, and the fragments of their vessels with which our shores are strewn.

"It should be made known that there is a settlement on Ashpé Bay, to the southward of Cape North; as from want of this information, many an unfortunate seaman has perished from cold and hunger, after escaping shipwreck; and that vessels of any draught of water may safely anchor all round the island, as wind and weather may require. The soundings, at half to three quarters of a mile are 7 and 8 fathoms."†

But, to revert to the currents. The British frigate, *Tweed*, on her passage to St. John's, Newfoundland, struck upon the coast, near Cape Spear, and was wrecked in the night of the 5th of November, 1813. This event, most probably, was the effect of an unknown south-westerly current.

To different currents must be attributed the loss of the sloop *Comus*, the transport Harpooner, H. M. ship *Drake*, and the brig *Spence*, all of which were lost, at different times, upon *one spot*; the little bay, called *St. Shol's Bay*, on the South coast of Newfoundland, and lying between Cape Freels and St. Mary's Bay. The particulars of all

* Substance of a communication to and from Mr. Wm. Heron, of Greenock.

† It has been justly observed, that a lighthouse on the Isle of St. Paul, at the entrance of the Gulf, would be eminently useful. We hope that one, worthy of the name, will be established here.

these melancholy events have been given in our Book of Directions for Newfoundland, 1824; and, therefore, need not be repeated. The *Comus* was from the west, and was lost in the night of the 24th of October, 1816, after having sounded, as supposed, on the inner edge of the Green Bank. The *Harpooner*, a transport, with troops, was from Quebec, and bound for London. She struck at 9 p. m. of November 10, 1816. The *Drake* sailed from Halifax for St. John's, 20th June, 1822, under very favorable circumstances, upon a direct course, for Cape Race; but on the 23d the weather became thick, and at noon she was supposed to be 90 miles from Cape Race, but at 7½ p. m. breakers were reported a-head, and the ship was soon after a total wreck. The *Spence* was from Richibucto, in the Gulf of St. Lawrence, with lumber, bound to Liverpool, and was totally lost at St. John's, at 4 p. m. 16th July, 1822.

These events imperiously demand an enquiry into the causes; but it does not appear that any measures have been taken for an investigation. The four vessels, it may be seen, were all from the *westward*, and all, it may be presumed, were set to the *northward*, as well as to the *westward*, of the situations which they were supposed to occupy, and the route which each intended to pursue. They can, at present be accounted for only by the supposition of currents winding round the coast, opposing each other, and operating, as above explained.

It has been already shown that the waters of the St. Lawrence run off partly to the S.W. from Breton Island; so that here, likewise, allowance for a westerly set is to be made: for, as Mr. Darby has said, "On the South side of SABLE ISLAND, the *Current*, in shoal water, with prevailing South and S.W. winds, sets rapidly eastward until it reaches the end of the N.E. Bar. It then unites and blends with the *St. Lawrence' Stream*, which passes the Bar in a S.S.W. direction, and runs strongest in April, May, and June. I have sufficient reason for believing that the Gulf Stream, on the parallel of 42° 30', running E.N.E. occasions the St. Lawrence' Stream, then running S.S.W. to glide to westward. The strength of this stream has never been noticed, and three-fourths of the vessels lost on Sable Island have been supposed to have been to the *eastward* of the island, when, in fact, they were in the longitude of it." (See Note 1, page 31.)

The Winds hereabout have been noticed on page 68; and there can be little doubt that their irregularities produce as various changes in the Currents.

9. ON THE GENERAL CAUSES OF THE CURRENTS, &c.

"It is well known how easily a current may be induced by the action of the wind, and how a strong S.W., a N.W., or even a N.E., wind on our own coasts raises the tide to an extraordinary height in the English Channel, the River Thames, the East Coast of Britain, &c., as those winds respectively prevail. The late ingenious Mr. Smeaton ascertained, by experiment, that, in a canal of 4 miles in length, the water was kept up four inches higher at one end than at the other, merely by the action of the wind along the canal. The Baltic is kept up 2 feet at least by a strong N.W. wind of any continuance; and the Caspian Sea is higher, by several feet at either end, as a strong northerly or southerly wind prevails. It is likewise known, that a large piece of water, 10 miles broad, and generally only 3 feet deep, has, by a strong wind, had its waters driven to one side, and sustained so as to become 6 feet deep, while the windward side was laid dry. Therefore, as water pent up so that it cannot escape acquires a higher level, so, in a place where it can escape, the same operation produces a current, and this current will extend to a greater or less distance, according to the force by which it is produced or kept up by the wind."*

These facts are so well ascertained, that, it may generally be taken for granted, a certain degree of current will obtain on the Atlantic, after a continuance of any uniform wind, where the sea would be otherwise in a placid state, and unaffected by other causes. For, it is supposed that, the winds, where uniform and permanent, produce currents equally uniform and permanent. Hence it is, that the winds between the tropics, having a general course westward, protrude the water of the Atlantic in the same direction, and cause the flow of a current the same way, unless where it meets with land, islands, or shoals, to obstruct its course or change its direction, or where it runs through channels which draw it a different way.

There is reason to believe that, the great currents within the torrid zone are increased by the influence of the moon, which draws them on from East to West. One instance that currents are affected by this cause, is, that, in the Faro, or Strait of Messina, between Sicily and Calabria, in the Mediterranean Sea, where there is *no rise or fall*, a current sets to the northward and southward alternately, for six hours, having every appearance of being governed solely by the lunar influence. Other instances might be given; and there is little doubt, but the power of the winds is blended with the attraction of the moon in forming the currents which set westerly from the Atlantic into the West-Indian sea.*

In the year 1804, Captain James Manderson, of the Royal Navy, published "An Examination into the true cause of the Stream of Florida," &c. In this treatise he considers the floods of the Mississippi as the 'prime mover of the Florida-Stream;' and he presumes that it is caused by the waters which fall into the Gulf from that and other rivers. We have not yet, however, found many persons who have considered his opinions as correct. Captain Livingston, on this subject, says, "From the best information I could obtain, relative to the quantity of water discharged into the sea by the Mississippi, Rio Bravo, &c. &c., there seems no probability that, in the aggregate, they exceed a three-thousandth part of the water which is discharged through the Strait, between the Florida Reefs and the Bemini Kays, or the narrowest part of the Strait."

Upon the hypothesis of Captain Manderson, Edmund M. Blunt, of New York, in an Appendix to the '*American Coast Pilot*,' states that, the velocity of the Gulf-Stream may be calculated by the *rise and fall of the floods in the Mississippi*. Thus is one error propagated upon another! "I have," adds Captain Livingston, "experience of the contrary. In August, 1818, the river Mississippi was *uncommonly low*, and I never saw the Gulf-Stream run with greater velocity. The trade-winds raising the level of the Gulf of Mexico seem to me the principal cause of the Gulf-Stream.†

"I am of opinion that its velocity depends on the motion of the sun in the ecliptic, and the influence he has upon the waters of the Atlantic: as, when the sun's declination is North, the N.E. trade-wind blows fresher, and extends farther to the northward than when the sun's declination is south. This causes a greater pressure of water towards the Caribbean Sea, and a superior elevation of the surface of the Gulf of Mexico, the superfluous water of which escapes by the Strait of Florida, where it is least opposed by the trade-wind, which only affects it laterally, (except in the short distance between the Dry Tortugas and the Salt-Kay Bank,) and even there the effects of the trade-wind must be very much diminished by the Bahama Bank, with the islands and kays thereon.

"There can be little doubt that the attraction of the sun, while in the northern hemisphere, influences the current which generally prevails about Madeira, and causes it to set with greater velocity towards the southward and eastward. One well-known fact seems to corroborate this idea, namely, that the above-mentioned current is always much stronger in the summer than in the winter months. On a reference to my journals, it appears that, although we were a considerable time in the limits over which the influence of the Gulf-Stream generally extends, that, in the forenoon of Friday, the 19th, and on the whole of the 20th of February, we did not feel its effects in the least degree; the water appearing, during that time, to have been perfectly stationary. It may, also, be remarked, from the journals of my voyage through the Strait of Florida, in September, 1818, in the ship Asia, and in March, 1819, in the brig Dispatch, how very little we gained, in the latter instance, from the assistance of the stream, when compared with the manner in which it hurried us to the northward on the former. All

* Particular convulsions in the interior of the earth sometimes occasion an extraordinary derangement of the tides, &c. After a recent occurrence of this nature in the Mediterranean Sea, called by the Italians a *sci-earthquake*, the course of the tides in the Gulf of Spezzia was totally deranged for the seven or eight succeeding days. But the ebb and flood were sensibly perceived at intervals of a quarter of an hour, half an hour, and an hour, during that whole space of time.

† In Mr. Blunt's Book, edition of 1822, the Remarks on Winds and Weather, page 239, are those of Capt. Geo. Walker, given in our former editions, and in the present work, page 68; those on pages 244, 5, were written by the same gentleman, as shown in our page 69. Some copious extracts on the Gulf-Stream, pages 243, 9, 50, 51, 52, &c. to 258, have been extracted from our former editions: as are also the General Observations on the Winds, Tides, and Currents, &c. pages 418 to 427. As Mr. B. has not done it, we take this opportunity of showing where these matters have originated, and to whom they properly belong.

this tends to confirm me in the opinion, that the velocity of the Gulf-Stream depends almost entirely on the sun's place in the ecliptic."—*A. L.*

It may here be remarked, that the Gulf-Stream is augmented during the rainy season of the West-Indies; and reaches its highest parallel, (about $42^{\circ} 45'$ N. between 56° and 57° W.) in the summer only. In that season it there spreads over a vast extent of the oceanic water. It is also to be recollected that, in the same rainy season, the waters of the Caribbean Sea, which is then surcharged, seek an escape along the Colombian coast to the eastward, as well as by the Channel of Yucatan to the west.

The EASTERLY CURRENTS in the Northern part of the Atlantic, and which, in the Bay of Biscay, exert their tremendous effects, so as to be proverbial, originate in the north, as we have described, and then conform to the winds, which, in these regions are, as already shown, mostly from the N.W., and violent during a great part of the year.

The more general prevalence of westerly winds off the coasts of the United States operate to produce a depression of the water off those coasts; and, of course, contribute to an easterly tendency in the waters of the ocean.

The indraught into the Strait of Gibraltar is attributed to the evaporation of the Mediterranean Sea, which appears to be the cause of the currents setting immediately in that direction, and of biasing the water from the west.*

These circumstances, combined, must indisputably produce the set or drift of a great portion of the Atlantic to the East, E.S.E., and S.E., which, however, varies with the winds, with the seasons, and local circumstances.

The auxiliary winds on the African Coast are the mean of continuing and carrying it down that coast in the manner in which it has been described.

To the prevalence of westerly winds and easterly currents is to be attributed the shorter period of voyages from America to Europe than from Europe to America; a fact established by general experience.

At any considerable distance from the Coast of America, the easterly current, caused by the action of violent West or N.W. winds, is seldom felt to the southward of latitude 36° ; consequently, the sea about the Bermudas, and thence southward, is free from the influence of this current. The currents here, though slow, are produced in the direction of the wind, particularly when it is of long continuance. These currents are found stronger near the islands and rocks of Bermudas than at a distance, because the obstruction which the water meets with from the islands causes it to run proportionably faster past their sides. In a brisk gale, the current here has been experienced from 12 to 18 miles in the 24 hours, in the direction of the wind; at other times, when the wind was not settled, no current has been found.

To continued westerly winds are to be attributed the common occurrence of a passage from Halifax to the English Channel in 16 or 18 days, with such currents as those which carried the bowsprit of the Little Belt, sloop of war, lost near Halifax, in 18 months, to the entrance of Basque Roads.† The currents of the Atlantic have sent to the shores of the Hebrides the products of Jamaica and Cuba and of the southern parts of North-America; but we know not the courses, or tracts, through which these articles may have been impelled, nor the spaces of time in which they were afloat;‡ all this is conjectural, and furnishes matter for investigation. We still, as already noticed, want DATA, or a more extensive knowledge of facts.

Lastly, Major Rennell is of opinion, that those transient and contradictory currents, that are met with in the mid-ocean, are owing to gales of wind, which sometimes are but narrow in their column of air, but affect the surface very strongly so far as they extend.

* This was the opinion of Dr. Halley, which has been controverted by those who suppose that the effect may be accounted for by the notion of an under-current, setting outwards. The flood-tide, on either side of the Strait, does certainly set outward, but the ebb sets inward with the general current. See the remarks on the Tide of the Strait, page 77. The easterly indraught appears to commence at about 100 leagues West from the mouth of the Strait.

† Quarterly Review, January, 1816.

‡ A bottle was thrown into the Sea from H.M.S. Newcastle, 20th June, 1819, in latitude $38^{\circ} 52'$ N. and long. 64° W. (the meridian of La Have Bank,) for the purpose of finding the direction and strength of the current. On the 2d day of June, 1820, it was found on shore in the Rosses, on the N.W. of Ireland, immediately in the vicinity of the island of Arran, by Mr. Nassau Forster, who gave a regular notice thereof. There can be no doubt, that, near the coast of Ireland, the current blends with the tide of flood, which sets in from the S.W.

4. OF THE PASSAGES OVER THE ATLANTIC.

1. OF SHIPS BOUND TO AND FROM THE EAST-INDIES, &c.

M. D'Après de Mannevillette, in his Directions for navigating from the English Channel to the East-Indies, says, "When you steer out of the Channel, you ought to shape your course so as to pass Cape Finisterre at the distance of 25 or 30 leagues: this distance, he adds, will be sufficient, in whatsoever season of the year your voyage may happen: you may, indeed, double that cape still nearer, if circumstances require; but, from its latitude, you should always shape a course for the island of Madeira.

"Though a sight of that island is not indispensably necessary in this passage, it is proper, however, to gain a sight of that, or of the Island of Porto Santo, that you may be able to keep on your course afterwards with greater certainty, whether you pass between the Canary Islands, or leave them to the eastward, as may be judged most convenient."

The reason of doubling Cape Finisterre at the above-mentioned distance is, that you may not be embayed by wind or currents within the Bay of Biscay. The distance, in rounding the cape, may be from 20 to 50 leagues. With a westerly wind, give it sufficient offing; or, in hazy blowing weather, it may be dangerous to stand to the southward in the night. See the remarks on Currents, pages 82 to 94, &c.

Gales from W.N.W. have frequently continued to blow into the bay for several days successively. Several outward-bound East-Indiamen have been driven far into it, in April and May; and, should a ship in this situation lose her masts, and be driven on a lee-shore, the consequence would be dreadful.

Modern navigators, who have chronometers, prefer passing to the westward of Madeira, instead of steering for that island, at any convenient distance, beyond 7 or 8 leagues. Thus they generally have steadier winds; particularly in winter. In November, December, and January, westerly gales prevail here, which produce eddy-winds and severe squalls near the land, occasioned by the high land's obstructing the regular course of the gales; and, besides, the weather here is very precarious.

M. D'Après goes on, "In the passage from the Coasts of France to the Canaries, you may frequently find differences in your reckoning to the eastward, which arise most probably from the indraught of the currents towards the Strait of Gibraltar: some have made the land on the Coast of Africa when they expected to have discovered Tenerife; others have gained sight of Allegranza, off the northern part of Lanzarote, instead of Tenerife; and, though the errors in reckoning may not frequently be so considerable, yet it is safer to be on your guard, when you judge, by your reckoning, that you are in the latitude of these islands, especially in the night-time, or when the want of moonlight, or very thick hazy weather, prevents you from discovering dangers at such a distance as to be able to escape them.

"The differences to westward, though much more rare, are yet not without example; chiefly when the winds have hung contrary for some time after the departure from the ports of England or France."

Ships are, however, now generally recommended to pass to the westward of the Canary and Cape Verde Islands; it having been found, that, in this route, steadier winds may be expected than those generally prevalent close to or among the islands. On the African Coast, W.S.W. and S.W. winds are frequent. The track now generally adopted, by ships having chronometers, is that to the westward of all the islands.

Should it be required to touch at Senegal, or Goeree, the best course will be, to make the Coast of Africa at Cape Blanco, latitude $20^{\circ} 55\frac{1}{2}'$; as there are soundings at 5 or 6 leagues off the coast, and no danger in making the land, either by day or night, provided the lead be kept frequently going: and thus you may steer up to the Cape.*

"Though it may seem natural enough not to suspect any errors of consequence in your reckoning in so short a passage as from the Canaries to the Isles of Cape Verde,

* Directions for proceeding hence, southward, will be found in the next section.

yet there are instances of such, as well to easting as to westing. It is with respect to errors in our westings, that I advise all vessels to keep 30 leagues to windward of Bonavista, before they stand in to make the land; lest, in keeping a direct course for that island, they should pass between the Isle of St. Nicolas and the Isle of Sal; and, finding themselves to westward of Bonavista, when they reckoned themselves to be still to eastward of it, they should miss of their refreshments at the Isle of St. Iago, an accident which has happened to several vessels.*

"The making of these islands is often difficult, occasioned by the fogs, which hang frequently around them. From this reason, those who come from the northward, ought to steer their vessels in this track with all possible precaution.†

"The most convenient course for vessels, which continue their voyage from the Canaries, without touching at the islands of Cape Verde or Goeree, is to steer, after they lose sight of the Canaries, so as to pass about 45 leagues West of Cape Blanco (or near the meridian of 20°); from this position they will make good their course due South, as far as to 12° N., and afterwards S.E. by S., till they meet with those variable winds which succeed to the trade-winds. By this they will keep the mid-channel between the Islands and Cape Verde, and coast along the bank below that cape, at a sufficient distance, even though they should make an error in their reckoning of 15 or 20 leagues to eastward."

But, as, when the sun is near the northern tropic, the trade-wind has been often found to fail within sight of the Cape Verde Islands, it has been recommended to ships, at these times, to pass the islands to the westward, at the distance of about 10 leagues, in order to preserve a steady wind, and prevent delay, by keeping clear of the light eddy-winds which then prevail near and among the islands. When to the southward of these isles, steer to the S.E., so as to get between the meridians of 18° and 23° W., upon losing the N.E. trade-wind. Should the southerly winds then commence, advantage may be taken of the shifts to stand on the tack which will gain most to the southward, and so as to cross the equator between the longitudes above-mentioned, if the winds will permit. Be cautious of making a long tack, either eastward or westward, with a dead southerly wind, in hope of having a better, unless the wind should veer, so as to produce much southing.

The S.E. trade-wind, at its northern limit, generally inclines far to the southward, particularly in July, August, and September, but frequently in other months. A ship, meeting this trade, should not be kept too close to the wind, but kept clean full, in order to make good way to the S.W., and clear of the southern limits of the westerly current that generally prevails about the equator.

It has been already shown, in the description of Currents, that ships, passing the line too far to the westward, run the risk of not being able to weather the Coast of Brasil. But *M. D'Aprés* has observed, that there is not one instance to prove that, by passing the line to the eastward of the limits above-mentioned, ships meet with calms of a long duration, and currents setting with great rapidity towards the River Gabon, as had before been generally imagined. His opinion has been corroborated by *M. la Perouse*, whose remarks on the subject are heretofore noticed. (Page 59.)

M. D'Aprés adds, "Vessels which sail from St. Iago should steer S.E. as far as the 12th degree of latitude: after that, S.E. by S. Those which depart from Goeree should steer S.S.W., if they desire to keep clear of the coast, till they reach the parallel of 10 degrees; thence their course should be S.E. by S."

His words, on crossing the line, are, "When the variable winds succeed the trade-winds, the best method of crossing the line with speed is, to take the advantage of the

* These are the remarks of *M. D'Aprés*, who adds, "In the month of December, 1750, a like accident happened to myself, when I commanded the ship *Le Glorieux*. During the night-time I passed between the Isles of Sal and St. Nicolas, without knowing it, which was occasioned by a difference in my reckoning of 80 leagues to the westward. Making sail, after that, to westward, in the latitude of Bonavista, I might have traversed about these isles without getting sight of any one of them, if an observation I made, of a lunar eclipse, in the month of December, had not convinced me of my error. So soon as I was certain of it, I directed my course southward, and a sight of the Isle of Fogo convinced me that I was right. To say the truth, I had neither had sight of Madeira or the Canaries."

† See Remarks on the Bonetta Rocks, which lie to the eastward of Bonavista, in the Directions for the Cape Verde Islands, hereafter.

very first variable winds, for gaining the ordinary track of the general winds so soon as you possibly can; and, for this end, to keep indifferently to that tack which bears most to southward, without troubling yourself about crossing the line at any determinate point, lest you make your voyage longer than is necessary."

Let us endeavour to enliven our subject, by some reflections from a volume of the Baron Alexander de Humboldt.

"From the time," says M. de Humboldt, "we entered the torrid zone, we were never wearied with admiring, every night, the beauty of the southern sky, which, as we advanced towards the South, opened new constellations to our view. We feel an indescribable sensation, when, on approaching the equator, and particularly on passing from one hemisphere to the other, we see those stars, which we have contemplated from our infancy, progressively sink, and finally disappear. Nothing awakens in the traveller a livelier remembrance of the immense distance by which he is separated from his country than the aspect of an unknown firmament. The grouping of the stars of the first magnitude, some scattered nebulae, rivalling in splendor the milky way, and tracks of space, remarkable for their extreme blackness, give a particular physiognomy to the southern sky.

"A traveller feels that he is not in Europe when he sees the immense constellation of the Ship, or the phosphorescent clouds of Magellan arise on the horizon. The heaven and the earth, every thing in the equinoctial regions, assume an exotic character.

"We saw distinctly, for the first time, the Cross of the South only in the night of the 4th and 5th July, in the 16th degree of latitude (North:); it was strongly inclined, and appeared, from time to time, between the clouds, the centre of which, furrowed by uncondensed lightnings, reflected a silver light.—If a traveller may be permitted to speak of his personal emotions, I shall add that, in this night, I saw one of the reveries of my earliest youth accomplished.

"When we begin to fix our eyes on geographic maps, and read the narratives of navigators, we feel for certain countries and climates a sort of predilection, for which we know not how to account at a more advanced period of life. These impressions, however, exercise a considerable influence over our determinations; and, from a sort of instinct, we endeavour to connect ourselves with objects, on which the mind has long been fixed, as by a secret charm. At a period when I studied the heavens, not with the intention of devoting myself to astronomy, but only to acquire a knowledge of the stars, I was agitated by a fear unknown to those who love a sedentary life. It seemed painful to me to renounce the hope of beholding those beautiful constellations which border the southern pole. Impatient to rove in the equinoctial regions, I could not raise my eyes toward the starry vault without thinking of the Cross of the South, and without recalling the sublime passage of Danté, which the most celebrated commentators have applied to this constellation;

"Io mi volsi a man destra e posi mente
All' altro polo e vidi quattro stelle
Non viste mai fuor ch' alla prima gente.
Goder parca lo ciel di lor fiammelle;
O settentrional vedovo sito
Poi che privato se' di mirar quelle!"*

- * We are obliged to a respected friend for the following imitation:—

"I turned me to the right; my spirit flew
To the other pole: four stars shone sweetly bright,
Ne'er seen but by the primal privileged few.
The heavens seemed revelling in their glorious light;
O desolate north! thy melancholy clime
Looked never on their gladdening ray sublime!"

Compare and connect with this the words of the patriarch, "WHO, ALONE, spreadeth out the heavens, and treadeth upon the waves of the sea? Who maketh *Arcturus*, *Orion*, and *Pleiades*, and the chambers of the South?

"Lo, He goeth by me, and I perceive him not: He passeth on, also, but I perceive him not."—*Jos ix. 8. 9. 11.*

"Seek HIM who maketh the *Seven Stars* and *Orion*, who turneth the shadow of death into the morning, and maketh the day dark with night: who calleth for the waters of the sea, and poureth them out upon the face of the earth. *JEHOVAH* is his Name."—*AMOS v. 8.*

"The pleasure we felt on discovering the Southern Cross was warmly shared by such of the crew as had lived in the colonies. In the solitude of the seas, we hail a star as a friend from whom we have long been separated. Among the Portuguese and the Spaniards, peculiar motives seem to increase this feeling; a religious sentiment attaches them to a constellation, the form of which recalls the sign of the faith planted by their ancestors in the deserts of the new world.

"The two great stars, which mark the summit and the foot of the Cross, having nearly the same right-ascension, it follows hence that the constellation is almost perpendicular at the moment when it passes the meridian. This circumstance is known to every nation that lives beyond the tropics, or in the southern hemisphere. It has been observed at what hour of the night, in different seasons, the Cross of the South is erect or inclined. It is a time-piece that advances very regularly nearly four minutes a day, and no other group of stars exhibits, to the naked eye, an observation of time so easily made. How often have we heard our guides exclaim, in the savannas of Venezuela, or in the desert extending from Lima to Truxillo, 'Midnight is past, the Cross begins to bend.'—(*Personal Narrative*, II. 21, &c.)

ON THE RETURN TOWARDS ENGLAND, the equator should be crossed between the meridians of 18 and 25 degrees. When the sun is to the northward of the line, the longitudes of 21 to 23 degrees are to be preferred: because then light and variable winds extend far from the African Coast, especially in July, August, and September, when the sun is returning from the northward.

If the southerly winds become light, a North or N. by W. course may be kept, in order to reach the N.E. trade-wind as soon as possible; but, if variable light breezes are prevalent far to the northward, you should endeavour to pass the Cape Verde Isles at the distance of between 40 and 50 leagues.

In crossing the N.E. trade-wind, a ship's sails should be kept well filled, to enable her to gain speedily to the northward. In this tract the Sargasso or Gulf-Weeds will be met with, which are described hereafter, as existing in the SARGASSO SEA, and which are sometimes found as high as 41° N.

Beyond the northern limit of the trade-wind, ships generally cross the parallel of 32° N. in from 39° to 42° W.

Should the wind veer to the N.W. on approaching towards the Azores; you may pass through one of the channels of these islands, and thence pursue a course to the English Channel, according to circumstances.

It is not always advisable to pass to the eastward of these islands, because adverse winds often prevail from the northward between them and the coast of Portugal; and the currents are, also, generally unfavourable to this route: yet it has sometimes happened, that ships passing this way have, with S.W. and West winds, reached the channel sooner than those which have proceeded to the westward. With these S.W. and westerly winds, you must be cautious in approaching the channel, in case the current should prevail, which sometimes sets athwart it, as described in a preceding division of this work.—See pages 82 to 92.

REMARKS by M. KRUSENSTERN.—We shall now introduce, by way of illustration, Commodore Krusenstern's description of his route from the parallel of the Cape Verde Islands to the Equator, on his Voyage around the World, in November, 1803, with that of his re-crossing the Line on his return in May, 1806.

"The passage to the westward of the Cape Verde Islands certainly deserves the preference over that to the eastward: as experience has shown to all navigators, that, to the westward, a fresh trade-wind prevails, while to the eastward there are frequent calms. Indeed, very few examples exist of navigators' sailing between the Cape Verde Islands and the coast of the continent. I therefore recommend to all those who, on their passage to the equator, take the westward course, to steer in such a direction from the Canary Islands, as to cross the parallel of 17° , (or that of the Island of St. Antonio,) in $26\frac{1}{2}^{\circ}$, or even in the 27th degree of longitude; and then to steer S.E. by S. directly to the equator. They will thus entirely avoid these islands, which are of sufficient magnitude to alter the direction of the trade-wind, and it frequently happens that S.W. winds are met with here. Even if this should not be the case, the wind is always very moderate in their vicinity, and it cannot impede much to steer a degree and a half more to the west than a direct course, when it is with the certainty of keeping a steady wind.

"If, however, it be necessary to have a sight of St. Antonio, in order to correct the ship's reckoning, this may be done at the distance of 30 miles. At all events, especial care must be taken not to come within 20 or 25 miles of it; as there is otherwise the risk of being driven, either by storms or by calms, too near the land.

"When I was going to India, in the year 1797, on board the English line-of-battle ship, *Raisonné*, we experienced the danger of sailing too near this island; and, even in this voyage, were made aware of its vicinity: for, in the night, previous to our seeing St. Antonio, it suddenly became calm; but, so soon as we withdrew from the land, the wind freshened. Although we had lost sight of the island, and were in 27 degrees of longitude, the wind blew very moderately from the south and east. I waited now, with impatience, for the true N.E. trade-wind, that I might return to the eastward, which I proposed to do for about 20°, in order to keep clear of the southerly winds and strong easterly currents, which are found in the region between the N.E. and S.E. trade-winds; and I wished, too, not to cross the line more to the westward than the 24th or 25th degree of longitude.

"Ships have been driven, when crossing the line, to the westward of the 24th or 25th degree, by strong currents and a wind too southerly, so near to the coast of Brasil as not to be able to clear Cape St. Augustin. If the wind, however, will allow the passage of the line in 20° or 21°, a ship should not fail to do so, as she will then have the advantage of a wind directly free, so soon as the S.E. trade sets in; and will, of course, advance quicker to the southward. This, however, is rarely possible.*

"Our naturalists made several experiments to-day, to ascertain the cause of the sparkling of the sea, the result of which seemed to prove that it is not merely occasioned by the motion of the water, but is, in fact, produced by little organized beings. They took a dish, over which they spread a fine cloth, doubled, and poured the water on it, as it was taken out of the sea. It then appeared that several spots remained on the cloth, which glistened as soon as it was shaken, while the water which had passed through it did not seem in the least impregnated with phosphorus, although mixed with saw-dust to replace the want of the matter which was now separated from it, and might have been supposed to have given the sparkle to the water when in motion. Dr. Langsdorff, who examined these fiery bodies with a microscope, and has made drawings of several of them, found them to be, particularly the larger ones, in the form of crabs; and in the small ones he observed fibres, evidently denoting organization.—(See more on this subject in the *Description of the Canary Islands, hereafter*.)

"On the 10th of November, in latitude 13° 51' N. and longitude 27° 7' W., we fell in with the N.E. trade-wind. It was still, however, considerably to the eastward: namely, E. by N. and E.N.E. We held, therefore, as much as we were able, to the S.E.; and this was the more necessary, as we had to work against a strong current, which threw us back nearly 20 miles a day. On the 15th, at noon, when we were in latitude 6° 58' N. and long. 21° 30' W., the whole sky became overcast. About two we had some rain, and a squall of wind that continued with considerable violence during two hours. Throughout the night it was very thick, with little wind. We now found ourselves on the borders of the trade-wind, which, after this squall, we had entirely lost, and entered into the region where are found unsettled, and, for the most part, directly contrary, winds, calms, or violent squalls, accompanied by heavy showers, and a hot damp air, as oppressive as it is injurious to health. Several days passed in which we did not get sight of the sun, so that the men could dry neither their clothes nor bedding. I had not, however, a single invalid during the whole of this time. Every possible precaution, indeed, was adopted: I had fires lighted three or four times a-week in the hold, which were kept in during several hours, and which is, undoubtedly, an excellent method of drying and purifying the air. At Tenerife, I had laid in such a stock

* But see the preceding remarks, particularly those of *M. la Perouse*, page 59. Mr. Luccock, in his 'Notes' on Brasil, has said, "After passing the Cape Verde Islands, the mariner, who is bound to the southward, (for Brasil,) feels anxious about crossing the Line. With a good chronometer on board, I should run boldly on towards the American coast, being careful only to avoid falling to leeward of Cape St. Roque, and into the heavy current which sets close around it. Without a chronometer, or knowledge enough to use it with advantage, I should allow, from 17 degrees of North latitude, a westerly drift, beginning with five miles for 24 hours, increasing the allowance until the latitude of 5 degrees be attained, when it should be, at least, 20 miles a day. From that parallel to 13 degrees south, the drift will decrease, and then again become variable."

of citrons, potatoes, and pumpkins, that our supply was not exhausted even on our arrival at St. Catharine's. Instead of brandy, I gave the men a pint of the best Tenerife wine; and, in the morning and evening, some weak punch, made very sweet, with a good deal of citron-juice in it. We availed ourselves of every moment of sun-shine to dry and air the clothes and bedding. The constant rain, during which we had caught water enough for a fortnight, gave our people a good opportunity of washing their clothes; and I had an awning spread, entirely for their use, between the fore and main masts; where they, also, washed each other.

"This disagreeable heavy weather continued during ten days: in which time we had advanced only about two degrees to the southward; for we had to struggle against a very strong current, that drove us back daily about 15 or 18 miles. At the end of the ten days we had again a fresh north wind, which lasted nearly twenty-four hours, when it veered to the S.E., and settled in that quarter as the true trade-wind. We were now in latitude 2° N. and longitude 23° W.

"On the 26th of November, we crossed the equator at about 11 a.m., in longitude $24^{\circ} 20'$ W., after a passage of thirty days from Santa Cruz, Tenerife. Under a salute of eleven guns we drank the health of the Emperor, (Alexander I.) in whose glorious reign the Russian flag first waved in the southern hemisphere.

"I now directed my course towards the Island of Trinidad; the wind was, however, so much from the southward, and the current, at the same time, set so strong to the west,* that we had crossed the meridian of Trinidad in 7 degrees of S. latitude. The wind soon freshened, and became more easterly, so that we made a rapid advance, and steered as much to the southward as it would permit. The westerly current, indeed, still flowed; but it had much less force than at the equator. In 14° S. we lost the S.E. trade-wind, and had easterly winds, which, by degrees, veered to N. and N.W. During the whole time that the trade-wind lasted, we were accompanied by an infinite number of bonitos, and harpooned some of them almost daily. They made a fresh and palatable dish for our people."

On the RETURN TOWARDS EUROPE, 21st of May, 1806,† at three in the afternoon, the Commodore re-crossed the line, in longitude $22^{\circ} 18' 30''$ W.; and he says,

* The direction of the currents, from the equator to the 8th degree of south latitude, was S.W. by W. and W.S.W., running from 26 to 35 miles a day.

† Two days before, viz. on the 19th, at five in the evening, "we saw, in lat. $2^{\circ} 43'$ S. and long. $20^{\circ} 35'$ W. in the direction of N.N.W., and at the distance of about 12 or 15 miles, a singular phenomenon, but which, owing to the lateness of the day, we were unable to examine sufficiently close to ascertain the nature of it. A cloud of smoke arose to about the height of a ship's mast; disappeared suddenly; then rose again, and vanished entirely. It could not be a water-spout, nor a ship on fire, as some persons on board conceived, for the smoke rose much too high; and Dr. Horner was of opinion that, if the whole was not an ocular deception, occasioned by a peculiar refraction of the rays of light, it had all the appearance of a volcanic eruption, and was possibly the forerunner of some island."

We have not the least doubt of its being a volcanic eruption; and notice it has having probably left, at least, a shoal on the spot. See the description of St. Michael's, of the Azores, in the next section of this work.—EDITOR.

A sub-marine volcano certainly existed in the INDIAN OCEAN, in 1815, of which the indications were seen by the Hon. Company's ships Fairlie and James Sibbald, on their passage to Calcutta. It was thus described by an officer:—

"On the 1st of October our latitude at noon was $13^{\circ} 25'$ S., long. $84^{\circ} 0'$ E. We observed great quantities of stuff floating on the surface of the water, which had to us the appearance of seaweed, but were quite astonished to find it burnt cinders, evidently volcanic. The sea was covered with it during the next two days. Our latitude, on the 3d of October, at noon, was $10^{\circ} 9'$ S., and long. $84^{\circ} 20'$ E.: the surface of the water was so completely covered with the volcanic matter, that I should think it very unlikely to have been drifted any considerable distance; as, if so, it would probably have been much more scattered. In an old Chart, which I had on board, there is a sub-marine volcano placed in the same longitude, and latitude about $8^{\circ} 30'$ S.; and, from the great distance from any land where we found this curious phenomenon, I think there can be no other way of accounting for it, than the probability of such a volcano existing in the neighbourhood."

A sub-marine volcano, supposed to have passed over by the ship Dispatch, Capt. Brown, 6th Jan. 1789, has been laid down, from that gentleman's account, in $7^{\circ} 58'$ S., and $87^{\circ} 39'$ E. See the large Chart of the World, published by Mr. Laurie. Captain Brown's description is given in the ORIENTAL NAVIGATOR, new edition, page 245. Near the long. of 82° E. and $8^{\circ} 55'$ S., it is also said that the Triton, Capt. the Hon. W. Elphinstone, once felt a shock during the night.

"The

"The passage on the line in this longitude, or even more to the westward, on the homeward voyage to Europe, is not attended with any loss of time; for, even by running so much to the westward, a few degrees in so long a voyage cannot make any difference, and experience has shown that the winds in this direction are fresher; while more to the eastward there are frequent calms; and, as it is of itself a sufficient advantage to remain as short a time as possible in the unwholesome regions about the equator. I have, indeed, the authority of D'Après against me; but, in all probability, he thought more of a direct course than of the health of his crew.

"We found the VARIATION of the COMPASS, on the day of our crossing the line, by several sets of good azimuths, in the morning $12^{\circ} 8' 45''$ and in the evening $12^{\circ} 7' 15''$, West. In the year 1795, Captain Vancouver found it on the line, in the meridian of $21^{\circ} 35' = 9^{\circ} 20'$ W., which proves an addition of two degrees and three-quarters in the space of eleven years.* On my return from China, in 1799, the variation here was found to be $11^{\circ} 33'$; and, in 1764, Mr. Nicholson found it on the line in the longitude of $20^{\circ} 40' = 7^{\circ} 56'$; so that the variation of the magnetic needle in these seas is evidently increasing. This seems also to be proved by every known observation; and there is no part of the world where they can be made at sea with more accuracy than in the regions of the S.E. trade-winds, between the Cape of Good Hope and the Equator, the sea being constantly calm, and the weather mild and beautiful.—(1806.)

"On the 22d of May, in the fifth degree of North latitude, and 23d of longitude, the sea, with a fresh breeze from the southward, was very strongly illuminated during the whole night; more, indeed, than we had seen it in all the course of our voyage. The waves communicated their brightness to the sails, and the whole ocean appeared wrapped in flame. In the year 1792 the same circumstance was observed, precisely in this part, by Captain Garnault, of the *Ganges*.

"We did not fall in with the N.E. trade-wind until the 29th of May, when we reached latitude $6^{\circ} 37'$ N. Hitherto we had experienced the unpleasant weather that usually prevails in the regions between the Equator and the N.E. and S.E. trade-winds."

2. OF SHIPS BOUND TO AND FROM THE WEST-INDIES.

The courses of these ships are regulated by the winds and currents, which we have described. The consequence is, a circuitous track, requisite to be taken, not only to the West-Indies, but to the southern ports of the United States. For, having passed Cape Finisterre, as before described, the best course is then to the S.S.W., so as to gain the trade-winds quickly. The preceding observations on passing, or touching at, Madeira, &c., may, therefore, in this instance, be useful, as well as in the former.

SHIPS FOR JAMAICA generally pass to the southward of the island Montserrat, and thence proceed for the high rock called Alto-vela, off the southern point of St. Domingo, whence they take a departure for the eastern end of Jamaica.† When homeward-bound, they either pass through the Windward Channel or the Strait of Florida, as the wind, and other circumstances, may prevail or dictate.

Between the months of October and March, northerly winds prevail over the Mexican Sea and the adjacent regions; and, when northerly winds prevail in the Strait of Florida, the Windward Channel must, of course, be preferred: but, at all other times, at least generally at other times, the quickest, and therefore most eligible passage, is through the channel of Yucatan, and thence, with the Florida-Stream in your favour, through the Strait of Florida.

Although the Windward Channel appears, by the Chart, to be the shortest and readier passage, yet ships are frequently opposed here both by wind and current; as will appear by the following statement, made by an ingenious officer already quoted: "After the defeat of the French fleet, commanded by Count de Grasse, in April, 1782, and the British had arrived at Port Royal, in Jamaica, a squadron was detached

* We fear, however, that the different results cannot be considered as an absolute proof.—EDITOR.

† The Americans, who have been much in the habit of going to the West-Indies, with timber, &c., remark that when the flying-fish fly in swarms, and are uncommonly small, it is a certain indication of being near the West-India Islands.—*Andr. Livingston*.

to gain the Windward Passage, run down the Bahama Old Channel, and cruise to the eastward of the Havanna, to prevent a Spanish squadron, in the harbour, from effecting a junction with the French ships that had escaped into Cape François, [*Cape Haytien.*] For six weeks did the English squadron beat against fresh sea breezes and a lee-current; and, during that time, never advanced farther to the eastward than off Morant Harbour, though the ships were much strained by carrying a press of sail to attain the object; but, after struggling so long, were compelled to return, baffled, into port. Now, though the first object might have been to meet the Spanish squadron, on its way to Cape François, if it had sailed, yet, so soon as the effect of a lee-current was ascertained, the object of gaining the Windward Passage ought to have been immediately abandoned, when, by bearing away, with a favourable current, for some distance, and before a fresh trade-wind, Cape Antonio might have been passed the second day, the squadron have been off the Dry Tortugas on the third, and, by beating along the Florida shore, with a weather current, when to the eastward of the meridian of Havanna, it could have stretched over to Cuba in the night; and, in all probability, have gained the appointed station in six days, or even, perhaps, as soon as it could have gained Cape Maize, if the easterly wind had been moderate, and no current to contend with."

When the trade wind blows strong, and in frequent squalls, during the summer months, between Jamaica and Hayti, and a short turbulent sea is found eastward of the former, then will those bound for Europe or the United States shorten the period of their voyage by bearing away for the west end of Cuba, and passing through the Strait of Florida. For the Strait presents a more eligible navigation in these months than the Windward Channel. The sea-breeze will insure a quick run to the Channel of Yucatan; and the current, perpetually setting eastward between Cuba and Florida, will, in a few days, carry any vessel into the Strait, where it will be nearly impossible to remain much above two days, in the strength of the stream, after being on the parallel of the Bemini Islands, even if there were not a breath of wind.

But, as the North winds prevail in the Strait of Florida in October, and frequently during winter, when variable winds and strong land-breezes are not uncommon on the Coast of Jamaica, shipping will find this the most favourable period for gaining the Windward Channel. In January or February, if the wind offers a favourable opportunity for gaining the eastern end of Cuba, this track should be taken; but, if the sea-breeze be strong, the Strait of Florida should be preferred.*

When the sun has approached the tropic of Cancer, strong westerly winds begin to blow along the western coast of Florida, and prevail during the months of June, July, and August, from the Bay of Apalaché, southward. These westerly winds cause fluctuations in the atmosphere, which prevail more about the western end of Cuba than farther eastward; and near the Havanna they have little influence. At this season vessels from Jamaica have met a westerly wind in the Channel of Yucatan; others have experienced a fair breeze at some distance, after passing Cape Antonio; and the wind here will be found sometimes at N.W., West, and S.W., veering about variably.

The wind in the eastern quarter sometimes fluctuates about the western end of Cuba, but not generally.

At this season the wind blows impetuously off Jamaica, and in frequent squalls; and vessels bound thence to Europe, should universally prefer the leeward passage. They will probably pass through the Strait of Florida before they could gain the entrance of the Windward Channel, though straining, with every effort, against the wind.† The appearance of a favourable opportunity for passing through that channel should not be suffered to deceive; for it may be no indication of the general state of the wind eastward.

VESSELS BOUND FROM the WEST-INDIES to the ENGLISH CHANNEL, after having cleared the Strait of Florida or Windward Passages, may pass either to the northward or southward of the Bermudas, giving the islands a good offing, and attending to the preceding remarks on currents, &c. (See page 114.) In summer, the best track is to the northward of these isles, and within the influence of the Florida Stream; thence crossing over

* In sailing for the Windward Channel, get the coast of Hayti on board as soon as you can, as you may then find a windward current, and, in the evening, the wind off shore. See *Our New Directory for the Windward and Gulf Passages*, 1825.

† See *Observations of Winds*, page 64.

the tail of the Banks of Newfoundland, and passing to the northward of the Western Islands. In winter, the track to the southward of the Bermudas is to be preferred; because, in this season, gales of north-westerly wind may be expected from the Coasts of America: and, therefore, vessels should continue a little to the southward of latitude 30° , or in about $29^{\circ} 40'$, if wind permits, until certain of being to the eastward of the Bermudas; nor should they run to the northward of 35° or 36° , until within a few degrees of the Azores. Thus will the heavy gales be avoided, which frequently rage more to the northward.*

DIRECTIONS for SAILING to and from the WEST-INDIES and NORTH-AMERICA: translated from the 'Derrotero de las Antillas,' by Captain Livingston.

These advices, or directions, are simple applications of a principle derived from the general prevalence of the winds, as already described.

Were it not for the constant wind from the eastward, which reigns within the tropics, it seems likely that the maritime commerce, between the two hemispheres, would never have existed; for, by its means, not only are the voyages rendered very simple, which would otherwise be interminable, but people in the most distant regions communicate with facility: and thus the navigator, who is bound to the westward, has only to place himself within the limits of the general wind, in the certainty that, in this manner, he must effect his purpose in the shortest possible period. Such is the *first rule*, which ought always to be attended to for this navigation.

The *second rule* is derived from the first; it is, that any one, bound to the east from the west, ought to get out of the region of the general winds into that of the variables.

We have here the two precepts which direct the operation of navigators in extensive seas; and, in attending to them, we shall observe that, every one bound from the Peninsula (Spain and Portugal) to the eastern coasts of America, ought to get into the trade-winds as soon as may be, holding in mind an advice, which may be considered as a precept, that is, *never, in navigating extensive seas, to keep close hauled, but always take care to sail with the wind free; or, at least, to keep seven points from it.*

Taking it as granted that the first care of every one bound to America ought to be to get into the limits of the General Wind, it is clear that, with scant winds, the tack in the third quadrant (S.W.) will be most advantageous, and ought to be followed always when it can. All the endeavour ought to be to get into these winds without being particular as to the means, and without keeping close to the wind to pass between the coast of Africa and the Canaries; but taking the passage that suits best, be that between the Canaries and Madeira, or be it between Madeira and the Azores: and certainly either of these is preferable to that to the east of the Canaries; for the proximity of the coast of Africa deadens the wind, and, consequently, is unfavourable to the brevity of the navigation.

Having gained the General Winds, the navigator must take precautions conducing to prevent any error of situation in making his port of destination; for, if he who navigates by observations is exposed to be even ten leagues in error, he who has no more than dead reckoning to direct him may, probably, be six degrees wrong. It imports much to guard against this error; keeping it in view that, in proportion as it will be easy for any one, making a landfall to windward of his port of destination, to run down to it; so will be the difficulty, if he makes this landfall to leeward of his port, in beating up again in a sea wherein both the winds and currents are contrary. Even if bound to the coasts of the United States of America, it will be advisable to run into the limits of the trade-winds, in order to get to the westward in as short a time as possible: and, although this mode may appear long, on account of having again, after crossing, to augment the latitude, it will be sufficient to keep in view the following maxim, to convince any one of the contrary:—*If in the one way the distance is shorter, in the other the velocity with which the ship proceeds, towards her port of destination, more than balances it.*

There are, nevertheless, many occasions on which a vessel may run across to the American coast without reducing her latitude, and these occasions may be frequent in

* The most destructive hurricanes on record, in this part of the Atlantic, have occurred in the vicinity, or on the borders, of the Gulf-Stream. This is an important reason, for ships from the West Indies, bound to Europe, not to advance too far to the northward. See, farther, '*Voyage from the West-Indies to the Azores*,' attached to the description of those islands hereafter.

the forty or fifty days which follow the two equinoxes, as epochs during which the N.E. winds generally prevail: therefore vessels which, at these times, make their passages, may at once follow their voyage in high parallels, without descending to low ones.

In summer, as the region of the General or Trade winds extends to about latitude $28^{\circ} 30' N.$, it follows that the round about is trifling; and this circumstance ought to be attended to in the calculations which every captain of a ship ought to make before he fixes on the course he will pursue.

Recapitulating what we have said about the course which is most advisable for crossing to the United States, from the coasts of the Peninsula, it follows that, if the winds permit it, West is the preferable course; and, in case the winds will not allow of shaping that course, the most advisable tack will be that which comes nearest to it, if the voyage is made at the times above mentioned after the equinoxes; but if at any other time, a course in the third quadrant [S.W.] should be preferred; for this will carry the vessel soonest into the General Winds, with which the necessary longitude may be shortly gained.

VESSELS BOUND TO CUBA, during the rainy season, or season of the South winds, should pass to the northward of Porto-Rico and Hayti: but, during the Norths, they ought to go to the southward of these islands. The ports chiefly frequented are, St. Iago on the South, and Havannah on the N.W. If bound to the first, it is necessary, in whatever season, to proceed directly to it: that is, in the season of the Norths to steer from Cape Tiburon, to make some point on the South of Cuba to windward of the intended port, or even to windward of Guantanamo; and, in the season of the Souths, to steer from the Point of Mole St. Nicolas, almost West for the port, marking, in the first instance, various points on the coast of Cuba.

If bound to Havannah, in the time of the Norths, you should pass to the southward of Cuba, although you will have to return the distance between Cape Antonio and Havanna; because this inconvenience is not comparable to that which might be occasioned on the North side of the island by a hard North, which would not only expose a vessel to heavy risks, but might protract the voyage much longer than the course above described, because the distance in the latter case may be worked up in a short time.

From St. Iago de Cuba, as the coast is clear, a vessel for Europe may easily make her way by the Windward Passages, while all those which are bound from Havanna will take the Strait of Florida. The risks in the latter emanated from bad Charts, and ignorance of the currents: the Charts are now rectified, and the current is known.

By the STRAIT OF FLORIDA, we understand the space included between the meridian of the Dry Tortugas and the parallel of Cape Canaveral. The simple inspection of the Chart will shew this to be a bed or course, which, like a river, conducts the water to the northward. This river, or general current, flows first to the E.N.E. as far as the western meridian of the Double-shot Kays, by which Kays the stream is diverted from E.N.E. to N. by E., the direction which it pursues on the parallel of Cape Florida: thence to Cape Canaveral it runs North, with something of an inclination to the East.

As it is undoubted that this General Current is caused by a superabundance of waters, which seek, by this drain, to regain their level in the open ocean, it follows that, its rapidity will be greater or less, according to the said superabundance of waters; but, as a change cannot be momentary, on account of the great reservoir in which the water is contained, but progressive, and, of course, slow; we hold that, having once ascertained the velocity of the current, we may calculate it for three days, or more, in advance, without much error, if the wind remains in the same direction; for an alteration in the wind may affect the force of the current considerably, as already explained.

On the meridian of the Havanna stripes of current are, at times, found setting to the E.S.E. and S.E. from the Tortugas Soundings. Care should be taken not to confuse the southern differences, caused by this branch of the current, with those caused by the eddy current near the Colorados; the one giving eastern departure, the other west. The distinction is very clear, and can admit of no doubt, because the eddy current is met only from the meridians of Cavanas and Bahia Honda to Cape Antonio, and not farther out from the coast than the parallel of 23° degrees.

As the velocity of the current varies, it is requisite for every navigator to ascertain its strength as frequently as possible, while within the Stream. Every one who enters this

this channel, having marked well either the lands of Cuba or the Florida-Reef, so as accurately to establish this point of departure, ought to determine, in his *first day's* work, the velocity of the current by the difference of latitude by account and observation. We say during the first day's work, because the generality of common navigators make use of meridian altitudes of the sun alone to find the latitude : but it is very clear that *altitudes of the planets and fixed stars ought not to be neglected; not only because by this you cannot be in doubt of your real latitude, but also, because they may be more exact than latitudes deduced from meridional altitudes of the sun, when that luminary passes in the proximity of the zenith, and because these repeated observations, during the night, assure, as much as possible, the situation of the ship.* Thus you may go on, with a clear idea of the operation of the current, and the way that the ship is making. Having ascertained the velocity of the current, use can be made of it to find the ship's departure, and this knowledge will be most important when you fail in obtaining observations for latitude ; because, in such a case, wanting a knowledge of the difference of latitude given by the current, you will be in want of every thing ; but, if you know the velocity of the current, with it and the course which it follows, you may find the difference of latitude and departure which the current gives ; and which, though it will not give the position of the ship with that precision with which it might be obtained by latitude observed, will still approximate sufficiently to the truth to enable one to avoid danger, if prudence and seaman-like conduct are combined.

For those who have little experience in the art of navigation, we add :

1.—That it is most convenient to direct your course in mid-channel, not only because it is the farthest from danger, but because you will there have the strongest current, which is desirable.

2.—That, as you cannot ascertain, with all necessary certainty, the position of the ship, notwithstanding the rules given to diminish the errors occasioned by the currents, you ought, with the utmost care, to shun the eastern coast of Florida, as being very dangerous, the trade-wind blowing upon it ; while there is not the least risk in running along the Salt-Kay Bank, and the edge of the Great Bank of Bahama. Upon the latter, also, you meet with good anchorages, very fit to lie in during the hard northerly gales experienced between November and March, and which do not fail to cause many damages, and sometimes even force vessels to bear away, which is always dangerous, for the weather is always thick with such winds, and the worst case will be to run in one of them upon the coast of Cuba, when hoping to have made Havanna or Matanzas. Hence, therefore, so soon as there is an appearance of a North, the best way is, if near the Salt-Kay Bank, to anchor on it ; and, if near the Great Bank, to approach the edge of it, in order to be able to anchor when it may be necessary ; for, although you may have a hard North, so long as you can lie-to in it, you ought to pursue your navigation, as the current will certainly carry the ship through the Strait.

3.—It is very necessary to sight the Kays on the Bank, even though you have no fear of a North ; and there may be occasions in which every exertion should be made to make them ; especially if, from want of observations, the situation of the ship is not well known.

4.—When, owing to calms or light-winds, a vessel is in danger of being carried through the Strait by the current, she ought immediately to approach the edge of the Salt-Kay Bank, or of the Great Bank, to descend from it to the coast of Cuba, without trying to beat down the lost ground ; for, by doing this, she would only render the being carried through more certain.

5.—Should you involuntarily approach the Coast of Florida, you should take extraordinary care to examine whether you have advanced out of the General Current and into the Eddy. That you may know this, observe, the Eddy forms a remarkable and visible line between it and the General Current, which line of division is, in many places, out of sight of land ; that, in general, you have no soundings on it ; and that it shows, not only by the change in the colour of the water, but that also in it, during the greatest calms, there is a kind of boiling or overfalling of the water. From this line of division the water gradually changes colour ; so that near the Florida-Kays it is a beautiful sea-green, and, at last, it becomes almost as white as milk.

6.—When in the Eddy, you have to make the correction of currents on courses entirely different from those in the Stream. This is the more necessary to be remarked, because, from ignorance of this circumstance, several have been shipwrecked.

7.—When you enter the Channel, or Strait, from the Tortugas Soundings, with the intention of passing through, take care to become certain of the land of Cuba, or some part of the Reef of Florida, in order to have a good point of departure: for, although the latitudes and soundings on the Tortugas Bank are more than sufficient to ascertain the place of the ship, yet the variable set of the current toward the Havana may produce a serious error, if not properly attended to. The meridian of the Havana is, in a word, the best point of departure for ships bound to the north-eastward.

3. OF SHIPS BOUND TO NORTH-AMERICA ONLY.

By referring to the chart it will be seen that, from the Land's End of England to St. John's Newfoundland, the true bearing is W. 4° S.; and, from the same point to Cape Sable, or the S.W. end of Nova-Scotia, it is about W. 9° S. But the circumstances of navigation, in general, render a direct course more tedious and difficult than a circuitous route; and the best passages have been made by pursuing a high northerly course.

It seems probable, from all that we have said on the Winds and Currents, that, on prosecuting a north-westerly course, from the Bank of Channel Soundings, the Winds and Currents, respectively, may counteract and balance each other: that, on a farther prosecution of the same course, the winds will be found less westerly, and therefore more favorable than in the more southerly parallels; and that, in advancing towards the mouth of Davis's Strait, the advantages both of wind and current may be combined.

Caution must be taken not to advance too near the Eastern coast of Newfoundland, if bound to New Brunswick or the Southern ports; nor to the Eastern Coast of Breton Island, as here the vessel may be swept round by the strong westerly currents, which have been described on the preceding pages, (127, 8) and which, now understood, instead of producing mischief, may prove highly advantageous in facilitating the ship's course.

The propriety of these arguments has been confirmed by experience, in more than forty passages made to and from New Brunswick, &c. by Lieutenant Chas. Hare, of the Royal Navy, of which the last was in the fall of 1824. Annexed is a copy of that gentleman's communication.

“Ships from Scotland, in the spring of the year, and bound to New Brunswick, have always arrived sooner than those from the English Channel, which is attributed to their being more to the northward on leaving the land.

“Ships from Liverpool generally arrive before those which sail from the English Channel, the cause being the same.

“In the SPRING of the year, I would never go the southward of latitude 46° or 47° until I reached longitude 37° or thereabout; then edge to the southward as far as latitude 43° in order to avoid the ice-bergs, keeping a very strict look-out; this parallel (43°) I should endeavour to preserve, or nearly so, but nothing to the southward, until up to Cape Sable, Nova Scotia; for it carries you to a safe and proper distance from Sable Island, a place that cannot be too much dreaded. In this track you will be without the northern edge of the Gulf-Stream, and assisted by a south-westerly current from the banks until past that island.

“In the FALL of the year, my track is far more to the northward than in the Spring. On leaving the land as late as the middle of October, or thereabout, I generally steer to the north-westward until I get as far north as 55° , and until I enter the longitude of 30° , then edge to the southward, to cross the Banks in latitude 46° , shaping again a course to pass about sixty miles to the southward of Sable Island, as above. If bound to Halifax, and very sure of my latitude, I might be tempted to pass to the northward of Sable Island; but, at all events, it would be at great risk; and I should not, under any circumstances, recommend a stranger to attempt it; as the weather is mostly foggy, and the set of the currents unaccountable. The soundings on Banquereau are incorrectly laid down in every chart that I have yet seen; being, in fact, within one hour's sail of the N.E. Bar of Sable Island; from which cause I once very narrowly escaped shipwreck. Numerous Gannets are always hovering about this island, and are a very excellent indication of your near approach to it, particularly on the south side.

“By crossing the Banks thus far north, you will find the advantage as you approach the longitudes of Newfoundland and Nova Scotia: the strong N.W. and north gales having then commenced, you will frequently be compelled to lie-to for two or three days; and should then ensure sufficient drift, before you are blown into the strong influence of

the Gulf-stream; which would be the case at a few degrees to the southward, and inevitably in a S.S.E. direction, at an inconceivable rate. Last November (1824) the case occurred: the vessel being hove-to, under main-topsail and storm trysail, to the westward of the Banks, in latitude 45° , and was, in four days, swept into latitude $39\frac{1}{2}^{\circ}$, consequently into the Gulf-stream; when the longitude became also considerably affected, and I took the first opportunity of making a N.N.W. course, to get out of it as soon as possible.

"To prove the advantages of a northern track, late in the fall of the year, I may notice that I have, in one or two instances, read, in the American newspapers, the accounts of very long passages experienced by ships which met heavy gales in the latitudes of 35° and 38° , when several vessels were disabled, and others suffered loss of sails; yet, *on the same day*, in latitude 54° , I had moderate weather from the N.N.E. with top-gallant studding sails set; which strongly encourages me to believe that the blowing weather, incident to approaching winter, commences southerly, and inclines northerly as the season advances, and not the reverse; an hypothesis generally formed by English ship-masters, but, in my opinion, certainly erroneous.

"I am farther of opinion that the influence of the Gulf-stream, in the parallels from latitude 35° to 42° , whether from the warmth of the water or other natural causes, has a strong tendency to attract the wind from a western direction; as I have invariably found the wind more alternative in the northern latitudes before mentioned than the southern ones; and it unquestionably must be allowed, by all mariners of any observation, that gales experienced in the Gulf-stream, or its vicinity, blow with much greater violence than they do in that part of the northern Atlantic not under its influence: besides, the squalls from the southward or S.W. are much more sudden and heavy, and near the Banks they are attended with dangerous lightning. The thermometer (an instrument easily understood) is of the greatest importance for ascertaining your approach to it; and, if bound to the west, I would, for my own part, endeavour to avoid its effects as cautiously as I would a lee-shore: for it may be depended on, that no ship, however well she may sail, will effect westing in the Gulf-stream with a wind from that quarter; and it is to be remembered that its velocity is accelerated according to the strength of those winds; and its extent in breadth, at a few degrees to the westward of the Azores, is many more degrees than is commonly supposed.

"These observations, I hope, may be useful to my brother mariners engaged in these voyages; and permit me to say, that they are grounded on the experience of at least forty times crossing the Atlantic, in his Majesty's and the merchant service, and in the command of vessels in both; latterly in one of nearly four hundred tons burthen, the *Waterloo*, owned in St. John's, New Brunswick; and, as the Custom Books at Liverpool can testify, landed four full cargoes in thirteen following months; which, including the time required to discharge the same, then load outwards to St. John's, there discharge and load home again, leaves but very little time for the ship to cross the Atlantic eight times in fourteen months, which, in fact, was done.

"Still further, in corroboration of my approved northern track, allow me to observe that, in the fall of 1823, by keeping in a high latitude, the brig *Ward*, myself master, also owned in New Brunswick, performed a voyage out and home in seventy-two days. The same vessel likewise, on the 3d of October, 1824, left the English Channel, and arrived again in the Downs on the 3d of January following.

"I must add that, a strong well-found and well-manned vessel alone can perform these voyages; for they must be maintained with unremitting attention and perseverance.

"The necessity and propriety of the above remarks was particularly exemplified by the *Ward*, which, on her passing through the Downs, in 1824, left ships there which were bound to the westward, weather-bound, and found them there on her return, having been driven back by adverse winds; while she, getting out of the Channel, performed with ease a prosperous voyage to St. John's, New Brunswick, and back, exactly in three months, assisted by chronometer, thermometer, &c."

GULF of St. LAWRENCE, &c.—Those bound to the Gulf of St. Lawrence, after passing to the southward of the Virgin Rocks, on the Grand Bank and the Island of St. Peter, should keep a middle course between Newfoundland and Breton Island; not forgetting what has been heretofore said on the Winds and Currents, (pages 68 and 127.) Recollecting also, that the harbours on the coast, westward of Fortune Bay, are impeded with dangers; there are many rocks about the entrances, and most of the harbours are imperfectly known. The rocks are not to be seen in thick weather, and fogs very much prevail on the coast.

The little island of St. Paul, which lies to the north-eastward of Cape North, is bold-to, steep, and high; and, with a good look-out, in the day time, cannot be considered as dangerous even in thick weather. The land of Breton Island is very high, and though fogs are about it frequently, it is seldom so much obscured as not to be seen in time. On entering the Gulf, the Magdalen and Bird Islands will be seen, as they lay in the direct course from Cape North to the River of St. Lawrence.

There is, in clear weather, a safe passage between the Bird Islands and the Magdalens; but, in thick weather, it is advisable to keep either to the southward or northward of both, as the wind may permit.

In Pleasant Bay, on the S.E. side of the Magdalen Islands, there is clear and good anchorage, very near the shore; and it is a very safe place for vessels to ride in, with a westerly wind, and infinitely preferable to beating about in the Gulf with a foul wind. There is a safe passage into it between Amherst Island and Entry Island.

As the weather to the southward of these islands, between them and Prince Edward Island, is generally much clearer than on the North, the passage that way is preferable, particularly after the early part of the year, when S.W. winds mostly prevail.

See farther, our Book of Directions for the Coasts of Newfoundland, &c. 1824.

UNITED STATES.—The course of ships bound from Europe, to the ports of the United States, is controlled, in a great degree, by the operation of the Florida-Stream, as we have already shown. Little, therefore, requires to be added to the subject here. Those bound to the northern and middle ports, when passing the shoal grounds on George's Bank, should take care to pass between these shoals and the Stream. Also, when passing the Nantucket Shoals, to keep between them and the Stream. The south part of the Malabar Shoal, on St. George's Bank, is in latitude $41^{\circ} 35'$, and that of the Nantucket Shoals in $41^{\circ} 0'$. (*See the Description of Shoals, &c. hereafter.*)

By taking this precaution, so as to keep between the Stream and shoals, a ship may shorten her passage to New York, Delaware, Virginia, &c.; for she will have, in this track, the advantage of the eddy-current running contrary to the Stream, when the latter would retard her progress at the rate of 60 or 70 miles per day.

Ships crossing the Stream, when bound to the westward, must get over as quickly as possible; or, it is clear that, they will be carried far out of their course.*

It has been remarked that, "ships from sea, approaching any part of the American Coast between Long Island and Cape Hatteras, if in doubt about their reckoning, should take notice of what is commonly called the Gulf-weed, which is in greater plenty, and in larger clusters, to the eastward of the Gulf-Stream than in it, where the sprigs are but small and few. Within the Stream there is no weed, unless in rare instances, and there the colour of the water changes to a still darker and muddy colour." (*See the Description of the Sargasso Sea, in the next Section.*)

The outer edge of the bank off this part of the coast appears to be very steep; for it has been frequently found that, while the lead has been kept going, there have been found 45 fathoms, soon after 35, and a mile nearer shore only 25 or 20, fathoms; from these depths the shoaling to the shore varies in different directions.

The soundings along the New Jersey coast are the most regular, as the water there shoalens from 35 fathoms on the outer edge to 10 or 12 fathoms in sight of land, and thence to 7 fathoms near the shore; excepting only from 2 leagues South of Shrewsbury Inlet to the Bar of Sandy Hook, where the water is deeper. Here are 10 fathoms near the shore, and deeper farther out, with some patches of rocky bottom. In latitude $39^{\circ} 24'$ min., the outer edge of soundings lies 19 leagues from shore, and E.S.E. from Great Egg Harbour, 18 leagues.

For the WINDS on the South-eastern Coasts of the United States, see pages 68, 69.

* The following Notice relative to several short Passages across the Atlantic was given in a Liverpool Paper, January, 1824, and affords a pleasing demonstration of improved knowledge in the navigation of this ocean.

"The packet-ship *New York* arrived here on Thursday last, after one of the shortest passages, we believe, yet made between New York and this port. She sailed on the 16th of December and arrived here in the morning of the 1st of January, being little more than fifteen days. The *Mary Catharine*, which left Charleston on the 16th of December, made her voyage, from port to port, in nineteen days. The *Murmion* arrived in the evening of the 7th of January, in eighteen days from Charleston, and two more from that town." The winds, &c. must, of course, have been favorable.

SECTION III.

PARTICULAR DESCRIPTIONS *of the* COASTS *of the* ATLANTIC; *with DIRECTIONS for SAILING among the* ATLANTIC ISLES.

* * IN THIS SECTION the BEARINGS and COURSES are those by COMPASS, unless where otherwise expressed: but those given thus [*W.S.W.*] signify the TRUE: and the given direction of Wind, Tide, and Current, is always to be considered as the TRUE.

1. ENGLAND, FRANCE, SPAIN, and PORTUGAL.

THE Coasts of England and France have been accurately and minutely described in the Book of Sailing Directions for the English Channel, &c. It is not requisite, therefore, nor consistent with the limits of the present work, to repeat the descriptions given therein. But, as it is possible that a ship may be driven, by stress of weather, into the Bay of Biscay, we shall here introduce a few remarks on such of its harbours, or places of shelter, as may be resorted to, in case of emergency.

Of these harbours, the first, and probably the best, is that called DOVARNENEZ BAY, to the southward of Brest Harbour. This bay is, in general, fair and clean, and its soundings are so even and regular, that no leading-mark is required. The upper part shoalens regularly to 8 and 6 fathoms, within half a mile of the beach, with fine oozy sand. A large fleet may lie here with as much safety as in Portsmouth Harbour, being almost land-locked at such distance from shore, that no shells can reach.

It is also to be observed that, a strong wind, which may detain shipping here, would also keep in all the Brest fleet; and, with westerly winds, ships can turn out from this bay when none can move from Brest Harbour: so that it is a useful place for British ships of force, even during war.

A rock, called the *Basse Vielle*, uncovered at two-thirds ebb, lies at the distance of half a league W.S.W. [*S.W. $\frac{1}{4}$ S.*] from Point Chevre, the north point of the entrance; and there are several sunken rocks off the south shore without the bay; but between is a clear channel, $2\frac{1}{2}$ miles broad. In going in, you sail to the southward of the *Basse Vielle*, at about 2 miles from the south shore, and will thus have regular soundings, from 35 fathoms, rocky bottom, to 26, 24, and 22, fine sand, all the way till within the bay; thence there are regular soundings to 10, 8, and 6, fathoms. The bottom on the north side is mostly fine sand, as is that in the upper part of the bay, but the former is best for anchorage.

A clump of trees, with a little chapel in the midst, stand on the north side to the eastward of Point Chevre, having a windmill to the westward, and two to the eastward. With the windmill next to the eastward of these trees just open with Chevre Point, you will have passed the *Basse Vielle*, and may steer for what part of the bay you please; all being fair and clear, excepting what may be seen above water, and what may be near the shore. The general depths over the bay are from 18 to 12 fathoms; and all, as before observed, is clean ground.

BELLE ISLE.—This island, which is high, and seen from a great distance, may afford good shelter in a westerly gale. Its N.W. end is in lat. $47^{\circ} 23'$, and its S.E. point in lat. $47^{\circ} 16'$. The N.W. end of the island is surrounded with rocks, and nearly in a line between it and the Isle of Groais lies the rocky bank called the *Birvidoux*. If a ship, with the wind at N.W. or W.N.W., keeps between the latitudes above mentioned, when running for the island, on approaching it, she may steer along the south side, at the distance of two miles, to Point du Canon, the S.E. extremity. From off this point, haul up for Point Locmaria, the eastern point, which is situate about a league from the former. Under this point may be found anchorage in from 15 to 8 fathoms, sheltered from N.W. and westerly winds. Should the wind here veer to S.W., a ship may run to the northward of the point, and anchor on the N.E. side of the island.

The *Isle of Hedic*, which lies about $7\frac{1}{2}$ miles East [*E.N.E.*] from the East end of Belle Isle, has many rocks, with foul ground about them. The range, called the *Cardinals*, extend to the S.E. from the island, and the extremity bears E.S.E. $\frac{1}{4}$ E. 12 miles from the S.E. end of Belle Isle.* Should a ship be driven to the eastward of Belle Isle, she must give the Cardinals a good berth; then haul up to the northward for anchorage.

In the Bay of Quiberon, after you have brought the Cardinals to bear S.S.W., S. by W., or South, there is good anchoring, with clear soft clay ground, and very even soundings, in from 10 to 12 fathoms. With these bearings you will be shut within some foul ground, lying off the Cardinals, in an extent of 3 miles in length, with the Cardinals from W. by S. to S.W., and which has destroyed the cables of several ships of war.

Excellent water may be obtained from the wells at the Isle of Hedic, with numerous refreshments; the inhabitants being extremely inoffensive, civil, and obliging. Shingle ballast and fine sand are, also, to be procured in abundance.

ROAD or BASQUE.—This road lies within the isles of Ré and Oleron, the north-western extremities of which are distinguished by the light-houses mentioned in the Table of Positions, page 10. In running for this place, the Reefs, called the *Banches Vertes* and *Roche Bonne*, must be carefully avoided.†

The *Isle of Ré*, on its western side, is environed by shoals. Off its N.W. end are dangerous rocks, called the *Baleines* or *Whales*; and a rocky bank extends thence a league out to sea. The rocks on the S.W. side extend to the distance of half a league from shore; but they diminish thence to the S.E. end of the island.

Off the S.E. end of Ré, midway between it and the main-land, is a small rocky bank, called the *Lavardin*, dry at low water, spring-tides. It lies about a mile and a half S.E. by E. [*E. by S.*] from the S.E. end of the island.

Around the North end of Oleron is a shelf of rocks, called the *Antioche Rocks*, which extend 2 miles to the eastward of the light-house, but within which there is anchorage. On the Light-tower, two fires are kept in the night, one above the other, by which it may be readily distinguished.

On sailing in, it is safest to keep over towards the Isle of Ré, until near the S.E. end of this island; only taking care to avoid the *Lavardin*, above-mentioned. Then steer for the west part of the Isle of Aix, a flat island, with some houses on it, which lies about half way between Oleron and the main land. The road extends from the *Lavardin Shoal* to this little island, and has, from 10 fathoms close to the shoal, to 12 and 13 in the middle of the road; and from 5 to 9 fathoms at about a mile and a half to the North and N.W. of the Isle of Aix. There are 6 fathoms at half a league West from the island, and good ground.

The soundings in mid-channel, between the Isles of Ré and Oleron, are generally from 12 to 15 fathoms, shoaling towards each side. This channel is nearly 2 leagues in breadth. The French Man-of-war Road is on the South side of the Isle of Aix.

* See Mr. Price's Chart of, and Directions for, Quiberon Bay, &c.

† The *Roche Bonne* and *Banches Vertes* are two reefs, within a short distance of each other, partly above and partly under water; nearly two leagues in extent S.E. and N.W., and distant 12 leagues from Isle Ré, in lat. $46^{\circ} 15'$ to $46^{\circ} 17'$. Near them to the westward are 54, and to the eastward 30, fathoms of water.

COAST OF FRANCE.

THE FOLLOWING DESCRIPTION of Basque Roads, &c. is from the pen of Captain W. Smyth, R.N.—K.S.F., by whom it has been most obligingly communicated.

Basque Road is a fine anchorage, at the confluence of the Charente River, with a good hard bottom, carrying from 8 to 20 fathoms at low water spring-tides. It is formed by the coasts of La Vendee and Charente to the North, East, and South, and to the westward by the islands of Oleron and Ré, on the extremities of which stand the Baleine and Chassiron Lighthouses. In sailing in, care must be taken to keep the mid-channel, in order to avoid the danger of Antioche and Grignon Shoals. The French shipping ride under the protection of the small but strongly fortified island of Aix.

ROCHEFORT, where the French fleet is equipped and constructed, is about 16 miles from Aix, and possesses very considerable and commodious arsenals. ROCHELLE has a capacious haven, surrounded by a prodigious mole, reported to be 5400 feet in length, but it has not depth of water for large vessels. It, however, answers the purpose, as the trade from hence, and, in fact, all the coast, is carried on, during war, in small convoys of chasse-marées, under the protection of gun-brigs, prames, &c., which coast along, generally, within range of their own batteries. Their principal cargoes consist in wine, brandy, sugar, salt, (of which abundance is made at Ré,) coarse cloth, and a few other commodities. OLERON once belonged to the English, and was rendered famous, during the crusades, by the construction of the first maritime code of all the European nations, generally known by the appellation of the *Laws of Oleron*, issued by Richard the First of England. This is a populous and fertile island, about 15 miles long and five broad; the number of its inhabitants is generally estimated at 12,000; the chief town is defended by several forts, and a strong castle.

BAYONNE.—The little harbour of Bayonne may, in time of peace, afford shelter to small vessels, which are towed in by stout boats under certain regulations.* The land in the vicinity is low and level, excepting some little downs, covered with pines and other trees, which are rather more elevated than the rest.

The River Adour passes through Bayonne. Its entrance lies between two level sandy hillocks. At times the broken water extends a mile out from the mouth of the river, and the boats cannot get out. For the accommodation of vessels entering, in this case, there is a square pyramidal tower, having a flagstaff on its top, situated on a small sandy hillock, on the S.W. bank of the river; about a mile from its mouth: near this tower stands, on the ground, another flagstaff or mast. When these objects are in a line, it is the proper direction for the best passage over the bar: after which, steer in between the two piers forming the entrance of the river, and which are about half a cable's length asunder. Within the piers you are out of danger, and may anchor where most convenient, in $4\frac{1}{2}$ or 5 fathoms, a depth which continues up to Bayonne. The latter is a handsome town, at about a league from the sea. There are said to be only 3 or 4 feet over the bar at low water.

COAST OF SPAIN.—Off the northern coast of Spain, which is high, bold, and rocky, the depth of water, in general, is from 150 to 200 fathoms, foul ground and coral; but, in many places, there is no ground at that depth, even near the shore. The principal harbours on this coast are those of *Bilbao* and *Santander*; yet both of these are devious and shoal.

BILBAO.—Of the Bay of Bilbao a particular plan is given on the New Chart of the Bay of Biscay. Its entrance, which is three miles wide, is formed by the points, named Luzuero and Galea. The greater part of its coast is lofty, steep, and rocky; but the bottom of the bay, on the eastern side, is low and sandy.

The mouth of the river Bilbao is impeded by a bar, having less than one fathom over it at low water. Here are two piers or kays, at a quarter of a mile within which is the town of PORTUGALETE, off which is the best anchorage in the harbour. Spring tides rise about 13 feet. In winter a heavy sea sets into the Bay, which, at times, renders it impossible for the pilots to go off.

* See the New Directions for the Bay of Biscay, already noticed.

DESCRIPTION OF THE COASTS, &c.

If coming in, when the tide does not serve for taking the bar, with an unfavourable wind, you may come to in the Bay, midway between the outer points Luzuero and Galea, bring the latter in a line with Cape Villano, in 16 fathoms, with sandy bottom. There is here sufficient room, in case a heavy on-shore wind should bring home the anchor or part the cable, to let go a second anchor, before the ship can get ashore. In summer, you may lie nearer to the land, in from 10 to 12 fathoms, all the bottom being of sand.

On making the bay from the westward, POINT GALEA, on the eastern side, may be readily known by its white colour. Should you pass Santona, the bay may be thence distinguished by three sharp-pointed mountains: of these, the northernmost is that of LUZUERO, the middle one and highest, the hill of SERANTES, on the west side of the bay. The southern one appears like an island. On steering for the first, you will, of course, make Point Luzuero.

SANTANDER.—Of this harbour, also, a particular plan is given on the New Chart of the Bay of Biscay. Cape Mayor, or the Great Cape, on the western side of its entrance, lies in latitude $43^{\circ} 30' 10''$, longitude, $3^{\circ} 40'$. This cape is of moderate elevation, but steep, and has a watch-tower upon it. Cape Menor, or Little Cape, half a mile more to the S.E., has a battery on it. This is lower than Cape Mayor, and terminates in a low flat point, with a small reef of rocks below it.

On the same side, at the distance of one mile and three-tenths to the south-eastward of Cape Menor, is Point Puerto. The land between forms the sandy BAY OF SARDINERO, in which vessels anchor when the wind and tide do not serve for going into the harbour. The best anchorage here is with the Capes Menor and Mayor in one; and, at three cables' length from the former, you will find from 10 to 12 fathoms; bottom of sand: but more to the southward, it is all of rock or stone.

The extensive sands on the south side of the harbour frequently shift, and a great portion of them is dry at low water. On the north side, from Point Puerto eastward, the coast is rocky, and defended by several batteries. The town has a small pier.

With the wind blowing fresh, from the S.W. or N.W. quarters, it is impossible to take the harbour of Santander: but vessels may, with flood-tide, occasionally bring up in the Road of the Promontory, which is clean and roomy, and there wait for a wind. With an ebb-tide, it will be better to come-to in the outer bay, off the beach of Sardinero, as already described.

An islet, named *Mouro*, which is high and steep, lies in the entrance, at half a mile N.E. from Puerto Point; close to its eastern side is a large rock, and there is a shoal at a cable's length to the N.W. of it; otherwise there is deep water around it, and the channels on each side are clear and good.

CAPE ORTEGAL, Cape Prior, with the other headlands in the vicinity, are high and steep. The ground without generally rocky and foul. At the foot of Cape Ortegál are 9 or 10 sharp-pointed rocks above water, with 15 or 16 fathoms close to them; and there is a rocky shoal at half a mile N. by E. [*N. by W.*] from the cape. A watch-tower on the highest land, at a mile and two-thirds from the cape to the southward, is a good mark for distinguishing it from sea-ward. Hence to Cedeira the land is steep and rugged, but to the northward of Cape Prior it falls into sandy bays. At different distances from shore are many scattered rocks, on which the sea breaks in a swell.

Both the stream of tide and current of the sea set in towards the land of this coast; so that the utmost attention is requisite, in order to avoid being embayed with light winds. With a good steady breeze, large ships may, however, pass safely within two miles of Cape Ortegál.

FERROL.—From Cape Prior to the harbour of Ferrol, the land is highly mountainous, with large rocks, above water, along shore. The Bay, forming the entrance of Ferrol Harbour, is only a mile wide, and the channel from it into the harbour but 2 cables' length in its narrowest part. There is, nevertheless, sufficient depth in mid-channel for large ships, at all times of the tide, viz. 8 to 10 and 12 fathoms. When within, you keep over to the north side, where you may haul up, and anchor in from 4 to 6 fathoms, sheltered from all winds.

CORUNNA, &c.—The north part of the peninsula of Corunna is distinguished by the remarkable lighthouse, called the *Tower of Hercules*, constructed with three sides and having a modern lantern on the top. On the coast, without the elevation on which the lighthouse stands, there is a bank of rocks extending N.W. to a considerable distance. But, from the meridian of the lighthouse, a ship may range along the coast into the harbour, to the S.E. and South, and find anchorage with the town bearing S.W. in 14 and 15 fathoms.*

GENERAL REMARKS ON COMING IN WITH THE COAST ABOUT FERROL and CORUNNA, from the Spanish of TOFINO.—"During the night, ships should never advance too near to the land; for not only does, at times, a powerful current set in for the land from the N.W.,† but the streams of flood and ebb often draw vessels out of their computed situation, especially in winter, or in thick foggy weather, which is frequent here. In the day-time, the sandy beach at the bottom of the hills may often be seen, when the latter are obscured in mist and haze. Ships from the westward, which cannot take the harbours in the day, should not advance to the eastward of the meridian of Cape St. Adrian, or about Cisargas Isle, (8 deg. 44 min.) where they should stand off and on, according to the state of the wind; for lying-to may be dangerous.

"During south-westerly winds, the currents set, with great strength, between Cisargas Isle and Cape Ortegal; and vessels have often been carried thus to leeward of the harbour of Ferrol, where there is no place of shelter or safety. With north-easterly winds, a ship should run within two miles of Cape Prior, and thence steer for Cape Priorino, in order, if the wind be not very strong, to gain the anchorage in the Bay of Carino; or, to stand away, if it be so, for Corunna.

"In the neighbourhood of Cisargas Isle and Cape Prior, as well as off the intermediate points, it is necessary, in hazy weather, to sound frequently; for the soundings will be a monition before the roaring of the sea on the shore can be heard."

From CAPE ST. ADRIAN, the high land continues to the Bay of Camarinas, with rocks above and under water. CAPE VILLANO is of rock, not very high, but perpendicular towards the sea. Within it at a short distance, is a sharp peak, of a red colour, which, at a distance, appears like a tower. At the distance of a cable and a half, N.N.W. from the cape, is the *Rock of Bufardo*, steep-to, and over which the sea breaks.

CAPE TORIANA, which is three leagues to the S.W. by W. [S.W. by S.] from Cape Villano, makes a sharp and steep projection into the sea; it is not very high, and when seen from between N.E. and S.W., resembles the awning of a galley. At a distance it is not always distinguishable from the high land at the back of it. At two cables' length west from the point of the cape, is a small sunken rock, which breaks with a little swell.

The NAVE' of FINISTERRE, a high mountain so named, stands at the distance of five miles and two-thirds to the S.S.W. [South] from Cape Toriana. Its summit is flat; and, at about one-third of its height from the sea, there appears to be a short point with hummocks on it, and having at its base a small but high island. In the bay formed between Cape Toriana and the Navé of Finisterre, vessels may safely anchor during north-easterly and easterly winds, off a fresh-water rivulet, in from 6 to 8 fathoms, sandy bottom, but not in deeper water, as there the bottom is rocky. Care must also be taken not to advance too near the north shore, as it, also, is foul.

CAPE FINISTERRE is only half a league South from the Navé.‡ It may be readily known from sea; because there is a bight between it and the Navé, with low beach, and the land behind less elevated. As there are no other points like these on the neighbouring coast, they cannot easily be mistaken.

THE COAST OF PORTUGAL is variegated with rocky prominences falling away into low sandy bays. Its harbours universally require the aid of pilots. Such are Viana, Oporto, Aveiro, and even Lisbon. The latter has, however, a good channel, with 6

* See the new and excellent Chart of the Bay of Biscay, also the new Chart of Spain and Portugal, with the Harbours, on enlarged scales, lately published by Mr. Laurie.

† See Explanation of the Currents, pages 83, 86, 91, and 93.

‡ In Tofino's original Chart, Cape Finisterre is exhibited in lat. 42° 56' 30", long. 9° 13' 30"; but the Tables have latterly given it in 42° 54' N., and 9° 16' 15" W., as shown in page 11. The mean may probably be nearer to the truth.

DESCRIPTION OF THE COASTS, &c.

comes over the bar at low water, yet it should not be attempted by a stranger, lest the winds fall calm, and the strength of the current set him on the banks.*

LAGOS.↑—According to the latest observations of ☉ and ☽ and * ☽ * Lagos is in latitude 37° 8' 40" North, and longitude 8° 37' 45" West, which differs a few seconds from the position generally adopted, and which appears in the Tables of the scientific; but, from a number of coincidences, I should prefer this in a final determination. This place, and Villa Nueva, in time of war with Spain, are of the utmost value and import, more particularly if there is a blockade of Cadiz, as ships are dispatched there to water; on which occasion it is necessary to observe the following instructions. At half-flood the boats can get near enough to land the casks, and may be taken off as late as quarter-ebb. The tide ebbs and flows in Lagos River at two o'clock, full and change; it rises about 13½ feet in the spring, and 9 in the neaps. The bar is just covered at low water. It has 14 feet on it at high water spring-tides, and 10 feet at the neaps. In fine weather, about 180 tons of water may be rafted off in twenty-four hours. Refreshments, such as poultry, pigs, fruit, rabbits, pigeons, vegetables, &c., are to be procured reasonably.

VILLA-NUEVA.—In Villa Nueva River, water may be got in transports, at about 150 butts in twenty-four hours; which must be rafted three or four miles down the river with the ebb tide, as the water is too shoal for ships to go nearer the fountain where it is procured. There is a depth of sixteen or eighteen feet of water on the bar; but, in my opinion, it is only a summer watering-place; as the Portuguese told me, that, in winter, the bar is seldom passable for ships, as the breakers are very dangerous, and the swell a long way outside it. At the lower watering-place a butt may be filled in eight minutes, and in seven at the upper.

TRAFALGAR.—Cape Trafalgar, by the antients called the *Promontory of Juno*, is about fifteen or sixteen miles to the westward of Cadiz, and twenty-three or twenty-four

* The following description will add strength to this injunction. It is given from an interesting pamphlet, entitled, "Narrative of a Passage from the Island of Cape Breton across the Atlantic Ocean, &c. By John Luce." London, 1812.

The brig John Bull, from Breton Island to Lisbon, in the year 1802, arrived safely off the Tagus, and took a pilot at a short distance from the North Cachop, at the entrance of the river. Mr. Luce says, "A ship of about two hundred and fifty tons happened to be there at the same time. The wind being very light, and the tide coming out of the river, we both kept off and on: but, at about two o'clock, the pilot of the ship in company seeing a likelihood to have to remain out all night, became impatient, and made an attempt to push in, which proved fatal to his ship, to the whole crew and himself, and nearly so to us. He availed himself of a light breeze from the land, and made towards the entrance of the river, to pass between St. Julian's Castle and the North Cachop. Our pilot, seeing this, shook his head; but he said, 'If that man gets in to-day, and I keep the sea until to-morrow, reflections will be made upon me; the more so as this vessel sails so much faster than his.' He, therefore, decided on following. The ship had the start of us; however, we overtook her; but it happened to be in an awful moment; just as we came opposite to the castle, it fell calm on a sudden: a strong current, coming round the point facing the river, runs with great force immediately over the North Cachop, and there meeting the swell from the Western Ocean, causes tremendous breakers over that shore. Thus becalmed, we found ourselves in this current, and impelled towards what appeared certain destruction; both vessels not more than fifty yards from one another; having yet some head-way, we shot a little a-head of our consort, when, in a few minutes after, she was driven amongst the breakers; and, as it were, in the twinkling of an eye, dashed to pieces. Pilot and all hands perished within five hundred yards of us. They had lowered their stern-boat into the water; I saw two of the sailors in her, and a third going to jump from the fore-chains, when their ship first struck; in an instant, nothing more of either ship or men was to be seen. We most fortunately launched into another branch of the current, which just took us clear of the shoal. We went so near, that those on shore thought we had struck; and it was so reported at Lisbon, together with the loss of our consort, by express from St. Julian's. Thousands of spectators witnessed this scene of desolation and anxiety from the walls of the castle, and from numerous boats hovering along shore, but none dared to come to our assistance. The current drove us to sea again.

"We were all night out; the next morning, the wind having shifted to the westward, we got into the Tagus. On passing near the place of desolation of the day before, my bosom throbbed at the thought of the scene we had there witnessed, and I found myself greatly affected; but, whilst I was thus moved and contemplating in silence the theatre of destruction, the weather was delightful; we were in the midst of many ships entering the river, with their colours displayed. If any thing was heard, it was the joyous sound from the sailors around us; every thing appeared smiling, and the Cachops themselves, in causing the seas to rise, made them precipitate themselves into their own bosom, and that in most majestic grandeur, their white heads crumbling into foam."

† The descriptions of Lagos, Tilla Nova, Trafalgar, and Tangier, have been communicated by Captain W. H. Smyth, R.N.—K.S.F.

miles to the southward of it; its appearance is flat, and distinguished by a ... ing. Those unacquainted with the navigation between this and Cape St. Mary ... rally labour under great dread of a gale of wind from the S.W., and, from want of ... ing how these gales come on, frequently get into difficulties. The S.W. gales generally ... commence with the wind at S. by W. or S.S.W., and continue blowing on these points ... five or six hours, although the sea sets in from the westward; and it is too common for ... persons, unaccustomed to navigate in this bight, to have their minds impressed with the ... danger of the shoals lying off Point Regla, commonly called the shoals of San Lucar, ... and falsely represented as very alarming. Under this apprehension they are induced to ... haul their *starboard tacks* on board, and push for the Strait of Gibraltar; whereas the ... real danger lies at the entrance of this Strait, and consists of dangerous reefs of rocks, ... with uncertain soundings, in no wise to be depended on. Between Cape Trafalgar and ... Tariffa, (and when you suppose yourself round them, and the Straits open,) in thick ... weather, not able to see the land on either side, you will feel yourself in a very awkward ... situation to find out the drift of the ship, or ascertain whether you are in a fair way to ... push through the Gut: which you will be compelled to do, should the gale continue, ... and you are within the influence of the stream; for you can (as before observed) gain no ... information by the lead of the reef of rocks, which lie W. by N. of the Island of Tariffa, ... and are extremely dangerous. On the other hand, by standing to the westward, with ... the *larboard tacks* on board, at the commencement of a S.W. gale, when the wind is ... from the southward, for instance, at S.W. by S., and you make four points leeway, you ... will make a fetch to the westward of Ayamonte; or even with a N.W. course made ... good, you will weather the bar of Huelba, and the lead will inform you the distance the ... ship is off the land, fifteen fathoms being the very shoalest part you should stand into ... along the north shore.

The outer shoal of San Lucar is not at a greater distance than $2\frac{1}{2}$ miles N.N.W. [N.W.] from Point Regla; the ground, outside the shoal, is even and hard, with ten fathoms water close to it; about half a mile to the northward of it there is a spot with eight fathoms. No allowance is made for a S.E. current, which always prevails when out of soundings, and even in sixty fathoms.

A more particular description of the land, between Cape St. Mary and Cadiz, may be found in the Book of Sailing Directions for the Bay of Biscay, &c. Cape Trafalgar, the last great promontory of this coast, may be known by its remarkable figure, being flat, and terminating with two sharp corners or angles; one round tower stands on the east corner; to the eastward of the flat, the land is very uneven and mountainous. To the east of the flat land are high sandy cliffs, but none to the westward.

It is to be noted that the southern end of the reefs called the *Cabezos*, lies $5\frac{1}{2}$ miles, W. by N. [W. by S.] from the light-tower of Tariffa. This appears to be the spot on which the British frigate *Thisbe* touched, in August, 1804; the depth over which was estimated at 14 feet.

2. THE COASTS OF AFRICA, from TANGIER to CAPE MESURADO.

TANGIER.—This place is of importance to the navigator, both in peace and war, on account of the refreshments to be procured, which are almost the only traffic the Moors have. The principal articles are cattle, sheep, pigs, poultry, eggs, fruit, and vegetables, of which a limited quantity is allowed to be purchased by each ship.

The bay affords convenient anchorage for vessels of all sizes opposite to the town, in from 8 to 10 fathoms, sand; but it is to be observed that, on the eastern side, there is a rocky ledge, bearing S.E. by E. $\frac{1}{4}$ E. from Tangier Point, and S.W. by W. $\frac{1}{4}$ W. from Cape Malabat. This cape, in a line with Europa Point, Gibraltar, leads clear of the shoal; and the anchorage, therefore, lies with Gibraltar open of the cape. Ships move to the N.W. and S.E. with the longest cable to the N.W.; and it is proper to buoy up and protect the cables, as they may be exposed to injury from the hard roots of large sea-weeds, which grow in the bottom of the bay, as well as from coral, &c.*

* It is to be observed that the proper anchorage is in the centre of the Bay. On the west of this anchorage is, or lately was, a large old mooring chain, supposed to have been laid down in the reign of Charles II. king of England, and found to extend nearly in an East and West direction, and in a line with the north side of the town of Tangier; its West end being at nearly a mile from the nearest shore. Tangier Point is altogether surrounded by foul ground, to a considerable distance.

DESCRIPTION OF THE COASTS, &c.

who visit this place should pay implicit obedience to the advice of the natives to the conduct to be observed during their intercourse with the natives.

rounding Cape Malabat, some years since, at the distance of more than three quarters of a mile from shore, the Excellent, of 74 guns, touched upon a rock, previously unknown; at which time, from the starboard chains, were found $5\frac{1}{2}$ fathoms, and 6 from the larboard. Cape Malabat then bore S. by E. $\frac{1}{2}$ E., and the ship floated off in less than a minute. This rock is now known by the name of the *Almirante*, and described as having over its shoalest part 3 fathoms of water. There is also a sunken rock at nearly the same distance from Tangier Point, discovered by the *Pacifico* schooner, in 1818, and which lies with the inner coast of Tangier S. by W. [S. by E.]

Between Cape Spartel and Cape Cantin, as shewn on the Chart, there are regular soundings towards the shore. In this tract there are no harbours of consequence; those which exist being nearly choked up with sand.

From Cape Spartel to the town of Arzilla, the coast trends S.W. by S. 10 miles. It is generally low, but ships may sail along it safely at the distance of half a mile. There are 30 or more fathoms every where at a league from shore. On sailing along, the inland mountains may be seen at a great distance, covered with snow, even in April and May.

Between Arzilla and El Araiche, the ground is tolerably clean, but not very good, being coarse gravel, with 25 and 30 fathoms of water, at from 1 to 3 miles from shore. Before El Araiche the depth decreases, and there are only 4 fathoms at 2 cables' length from shore. In sailing along this coast, care must be taken not to advance too near, unless it should be with a strong easterly wind; for sometimes, in calm weather, there is here a heavy swell from the West or N.W., which would render it difficult to get off shore.

There is a remarkable white patch on the coast between Arzilla and El Araiche, which may be distinguished 5 leagues off; but the best mark is the Peak of Fas, an insulated mountain, resembling a sugar-loaf, which stands S. by E. $\frac{1}{2}$ E. [S.E. 5° S.] from off the entrance of El Araiche.

EL ARAICHE may be known by its castle, which commands the road, and is strengthened by several batteries on the banks of the river El Kos, upon which it stands. The best anchorage is with the town between the S. and S.S.E. The mouth of the river, which appears very broad, is really very narrow at low water; but there is sufficient water on the bar to admit vessels of 100 tons at high water.

Between El Araiche and the remains of Old Mamora, the land is very low and uneven, with some sandy hills. There are every where from 20 to 25 fathoms of water, at half a league from shore, and you may anchor off the coast hence to Sla or Salee. Ships, in fact, must sometimes anchor here, during a calm, to avoid being drifted by the currents, which set to the southward, along the coast; and the velocity of which, especially at the full and change of the moon, is frequently from one to two miles an hour.

The Peak of Fas, above-mentioned, serves as a mark for Old Mamora, from which it bears nearly East.

From this town the coast extends 10 leagues S.S.W. to Meheduma, or New Mamora. The coast is very clear, a little higher than the former, and readily known, being of white sand as far as about the middle of its declivity, while the upper part appears like cliffs. The river Sebou, on which the town is situate, is impassable, except in boats, or on rafts, at some distance from the sea, although navigable near the ocean. The town extends from the sea-shore to the top of the highest land, so that you may readily distinguish, from the offing, the walls of an old castle, situate in the upper part of it. Ships may anchor, at half a league from shore, in 12 or 14 fathoms, sandy ground: but, when the wind blows from the offing, and sometimes in fair weather, the swell is here very great, as well as along the coast. The best anchorage is with the town from S.E. by E. to S.E. by S.

In the summer, the wind generally prevails from N. by E. to N.E. along the coast. During winter, there is a blustering S.W. and S.S.W. wind; and, in this season, when it begins to chop about to the South or S.E., shipping must get off, for then it commonly shifts to the S.W. and W.S.W., with foul weather. When it changes to W.N.W. or N.W., the weather is likely to be clear.

Between Meheduma and Sla, or Salee, the coast is rather low, with double land, very even, with a white sandy strand, therefore readily known. At about half-way the strand rises, and thence, southward, the shore consists of black and steep rugged rocks, with small hills.

The towns of SLA and RABAT are divided by the river called the *Bu Regreg*. In this river, between the two towns, some sloops of war, belonging to the Moorish sovereign, are still laid up for the winter. But Mr. Jackson has said that, going thence to Mogodor, a few years since, the vessel in which he was, of about 150 tons burthen, struck three times on the bar: and, as the sand continues to accumulate, it is likely that, in another century, there will be a separation from the ocean at ebb-tide. The town of Sla, or Salee, is walled, and protected by a battery of 24 pieces of cannon, which commands the entrance of the river.*

Near the entrance of the river, at Rabat, on an eminence, are to be seen the ruins of an old castle, built in the twelfth century, and wherein some subterraneous magazines, remarkable for their strength, being bomb-proof, are still preserved; there is, also, the remains of a small battery, which defended the entrance of the river. Some batteries were rebuilt here, in 1774, on a more extensive plan; but the engineer has made the embrasures so close, that the guns cannot be conveniently worked. At a short distance South of the castle, on an elevated situation, is a square fort, the walls of which are about 2 miles in circuit, and strengthened by square towers; they inclose the castle, the town of Rabat, and a large space of ground, where stand a palace, and the mausoleum of the shareef, or emperor Sidi or Seedy Mohammed.

A remarkable old tower at Rabat, called the *Tower of Beni Hussan*, is the best sea-mark for this place. It is built of hewn stone, is 180 feet in height, 35 or 36 feet broad, and may be seen, in clear weather, 6 or 7 leagues off.† At a small distance to the Northward of it, are the ruins of an antient wall, on which were formerly a battery and castle.

The country in the neighbourhood is planted with vines, oranges, and cotton of an excellent quality. There are docks for ship-building, both at Salee and Rabat.

The road of Sla is dangerous for shipping, and the accumulation of sand at the entrance will scarcely permit a vessel of 100 tons to enter the river without danger. Vessels may lie in safety out of the river, near Rabat, from April to September inclusive; but they are not secure in the rest of the year, the wind blowing from the southern quarter, and often obliging them to quit their moorings. The best anchorage in this season is between the mosque of Rabat and the old tower of Hassan, keeping the former to the northward. As a great number of anchors have been lost in the road, much attention must be paid to the cables. The position of Rabat may be seen in the Table, page 13.

EL MONSORIA, shown on the Chart, is a square building, erected by the Sultan El Monsor, in the twelfth century, as a refuge for travellers during the night.

At FEDALA, a peninsula, frequently mistaken for an island, forms an indifferent shelter to small vessels. A roadstead here is supposed to be the only one, with the exception of Agadeer, wherein ships on this coast may ride in security during winter. This is owing to the land, South of the peninsula above-mentioned, projecting to the westward.

From the S.W. end of Fedala a rocky bank stretches about three miles to the west [W.S.W.] Hereabout, at from 2 to 6 miles in the offing, the depths are 15, 20, 25, and 30, fathoms, rocky ground; at 7 or 8 miles, the ground becomes sandy; and, at between 9 and 24 miles, the depth is from 50 to 100 fathoms, oazy ground.

From Fedala to the remains of the town of Anafee, the coast extends W.S.W. $\frac{1}{2}$ W. 3 leagues. The latter stands close to the shore, and is easily known by its towers, one of which seems almost as high as Hassan's Tower at Salee. The coast between is low, and bordered with small islets, all very near the land. At six miles to the westward of Anafee is a point with red cliffs, appearing, at a distance, like houses.

* See Mr. Jackson's Description of Marocco, &c.

† A particular description of this tower, &c., is given by M. Cassini, in his Voyage to Newfoundland and Salee, 1768.

From Anafee to the town of AZAMOR, on the west [*W.S.W.*], the distance is 15 leagues. This town, at the entrance of the River Morbeya, is a place of little consequence, and not adapted to commerce. The entrance of the river is dangerous, and the shore flat, having not above 8 or 10 fathoms of water for a league or a league and a half from shore, and foul rocky ground, so that it is not safe to anchor hereabout.

From AZAMOR to the ruins of the town of Mazagan, (*El Burreja*), on the *W.S.W.* [*S.W.*] the distance is three leagues. There is anchorage off the coast, at a league from the shore, in 15 fathoms, clear sandy ground; but at the west point of Mazagan is a ledge of rocks, which stretch to the N.E. [*N.N.E.*] about a league into the sea, and are uncovered at low water. The shore hence, towards Cape Blanco North, is every where rocky and dangerous, to a considerable distance from shore; and ships that stop here must anchor at two leagues off, in 35 or 36 fathoms of water, oazy ground: the swell is almost always very great, and the currents very strong. From Mazagan, or *El Burreja*, to Cape Blanco, the distance is 5 leagues. Between these places the high tower of Tet or Tid may be seen.

CAPE BLANCO NORTH.—This cape is a cliff, which appears at a distance like a wall, and remarkable from its white and red spots. In the bight on the S.W., which is formed by the cape, there is a good anchoring place, of sufficient extent for several ships.

CAPE BLANCO NORTH TO CAPE CANTIN.—Between these capes the coast is much higher than the coast between Cape Blanco and *El Araiche*. It trends to the S.W. $\frac{3}{4}$ W. [*S.W. by S.*] $12\frac{1}{2}$ leagues, and is safe all along, having only some small islets very near the land. At two leagues off the depths are forty and fifty fathoms, oazy ground. The currents are very strong, and generally run in the direction of the coast, S.W. by S. The highest spot of this coast is half-way between Cape Blanco and Cape Cantin, where once stood *Woladia*, of which remain only some ruined walls.

CAPE CANTIN, in latitude $32^{\circ} 35'$, is a steep headland, falling downward toward the sea, with a ledge of rocks projecting from it. On its summit is the monument or sepulchre of a Mohammedan saint, which serves as a mark, but is too small to be always seen.

From Cape Cantin to the North point of ASFEE or SAFFI BAY, the coast trends S. by W. $\frac{3}{4}$ W. [*South*] $3\frac{1}{2}$ leagues, and is much higher than the coast already described. Between these points, at the distance of a league from shore, is a rocky bank, extending North and South, *true*, having over it from 30 to 40 fathoms, and, at times, abounding with fish. From the North point of the bay (which is foul) to the town of Asfee, or Saffi, the distance to the S.S.E. [*S.E.*] is $2\frac{1}{2}$ leagues.

The antient town of ASFEE, or SAFFI, in lat. $32^{\circ} 20'$, is situated between two hills, which render it intolerably hot; and, in winter, very disagreeable, as the waters from the neighbouring mountains, occasioned by the rains, discharge themselves through the main street into the sea. The road is safe in summer; but, in winter, when the wind is from South or S.W., vessels are frequently obliged to make off to sea. The surrounding country abounds in corn, and two falls of rain in a year are sufficient to bring it to maturity.

The Bay of Asfee is nearly three leagues wide, and vessels may anchor at a league from the town, in 20 or 22 fathoms of water, gray and oazy sand. To anchor in the Road, the North point, on which stands a low tower, must be brought a little to the northward of N.N.E. Or, farther in the bay, the same point may be brought north (by compass) a little easterly, when the northernmost of two northern points will appear about a ship's length open, without the southernmost; and the high castle of the town S.E. by E. or S.E.; the depths 16 to 18 fathoms, fine gray sand. There is also anchorage within, in 15 fathoms, with the North Point N.N.W. or N. by W.; but these are the summer roads: in the winter, you must anchor farther from the land, in 20 or 22 fathoms, as already shown. You may boldly run in to the summer roads by night, with the castle bearing E. by S. or East.

If bound to Asfee, from the northward, shape such a course as will lead sufficiently to the westward of Cape Cantin, in order to avoid the rocks about that cape. You may easily know on which side of Asfee you are standing, as the land to the northward of the bay is high and uneven, and that to the southward of it is a plain even land.

From the South point of Saffi Ray, which is very low, to SUERRAH, or MOGODOR, the course and distance are nearly S.W. [S.S.W. 4° W.] 20 leagues. The coast, generally, is fair, clean, and of a moderate height. At seven leagues from Asfee is the mouth of the *River Tansift*, or River of Morocco. It was on this coast, at about two leagues S.S.W. from the river, that the *Lichfield*, a 50-gun ship, was wrecked, 29th November, 1758.

MOGODOR.—SUERRAH, or MOGODOR, is the only port on this coast which maintains a regular commercial intercourse with Europe. Its population has been computed at 10,000 persons. This town is built on a low flat desert of accumulating sand, which separates it from the cultivated country, and is defended from the encroachment of the sea by rocks, which extend from the northern to the southern gate; though, at spring-tides, it is almost surrounded by water. There are two towns, or rather a citadel and an outer town. Those Jews, who are not foreign merchants, are obliged to reside in the latter, which is walled in, and protected by batteries and cannon, as well as the citadel.

The wind being high all the summer, with little intermission, nothing grows here in sufficient quantity to supply the inhabitants; all kinds of fruits and vegetables are therefore brought from gardens 4 to 12 miles distant; and the cattle and poultry are also brought from the other side of the sandy hills, where the country, although interspersed with *Harushe*, or stony spots, is capable of producing every necessary of life. The insulated situation of the town, and the want of fresh water, which is brought from the river $1\frac{1}{2}$ mile distant, deprive the inhabitants of all resource, excepting that of commerce, so that every individual of the place is supported directly or indirectly by it. In this respect, it differs from every other port of the coast.

An island, which lies to the S.W. of the town, forms the harbour. This island is about $1\frac{1}{2}$ mile in circumference; and between it and the main land, on the South, is the anchorage.* There are here, in some parts, only 12 feet at low water; therefore, large ships do not enter the port, but anchor at about $1\frac{1}{2}$ mile westward of the *Skalla*, or long battery, which extends along the west side of the town towards the sea.

Mogodor has a beautiful appearance, at a distance from sea; the houses being all of stone, and white. The streets are, nevertheless, narrow and dull. A winter seldom passes but some ships are driven a-shore by the S.W. winds; and this happens generally between the 8th of December and the 18th of January, the season called *Liali*, by the Arabs, and the only period dangerous to shipping in the bay.

The North passage into the harbour is between the town and island. A great ledge of rocks extend from the main, among which those next to the island stand high above water. In coming from the northward, if you would sail in behind the island, you must run between it and those rocks, close by them, where you will have five fathoms of water. The best anchorage is under the island, in $2\frac{1}{2}$ fathoms, as there the ground is good.

A small reef extends from the South end of the island, towards the main land; and, on the South side of the passage, a bank extends from the main land to a considerable distance. In sailing outward, run along by the latter, and you will soon be in 4, and thence to 10, fathoms of water. The tide flows here, on the full and change, at 4h. and rises from 10 to 12 feet. The current is scarcely perceptible.

MR. JUDAH PADDOCK, in the Narrative of his wreck and captivity, in the year 1800, which is more particularly noticed hereafter, has made some useful remarks on the port of Mogodor; and he says, that the regulations of the police, with respect to the market there is a matter worthy of notice. Every morning an officer goes to each stall, and pastes up a piece of paper, upon which is written what is to be the price of beef for that day. So severe is this regulation that no seller dares to exceed that fixed price; though every one is at liberty to sell as much below it as he pleases. Thus much trouble is saved, and no imposition can be practised on the buyer, as the meat is rarely sold below the fixed price. The price of the meat is governed by the price of cattle, which are constantly for sale without the gates, and are always cheap.

The exportation of horses was utterly forbidden; but mules, asses, and horned cattle were permitted to be exported, after payment of a specific duty, similar to that laid on the other productions of the country.

* See the Survey of the Bay and Town, by Sir W. Sidney Smith, on the Chart of the Coasts from Gibraltar to Cape Blanco, published by Mr. Laurie.

"THE IMPOST was under a peculiar regulation, very agreeable to the mercantile houses, which was this; when a ship arrived, a report of her cargo was made, there were no custom-house forms, no bonds entered into for the Emperor's dues, but the goods were all landed, and put into his stores. One-tenth was then taken by the Emperor's officers, and the remainder was given up to the merchant, who took it away at pleasure. Articles, however, that were not used by the Mooselmin, such as ardent spirits, wine, &c. were subject to a particular duty, which being paid, those articles, like the rest, were suffered to be taken away from the Royal stores. The Merchants in Mogodor had but very little trouble in making this division between the government and themselves; for their correspondents, if made acquainted with this regulation, would, in shipping goods, have them packed in *tenth*s; for instance, ten pieces in every package of cloth, so that when the goods were all stored, it would require little time or trouble to divide them according to law. Smuggling was very rare. The guards at the city gate were so diligent, that any clandestine management could readily be detected.

"Duties on exports were paid at the city gates in the following manner: A merchant intending to ship a quantity of goods, goats' skins, for instance, informs the governor of his intention, and requests him to be at the gate on a given time of the next day. The governor attends in person, accompanied by a scribe, and a servant following with a mat for him to sit on. He looks at the bundles and counts them, points out a few which he orders to be opened and counted, and on being satisfied as to the number of skins in each, the scribe calculates the sum that he should receive as government dues. On his demand, it is counted out to him by the merchant, who previously knew the exact amount. The scribe counts again, and informs the governor if it be correct, who then gives permission to ship the articles, and returns with the scribe and his servant. I frequently thought, while I was in Mogodor, that, of all the parts I had visited, none was nearly equal to this for doing business, relating to imports and exports with ease and correctness."

At the distance of about two miles inland from Mogodor is the *Commerce Garden*, an agreeable place of resort for the European residents and strangers, and which has advantage of a fresh-water rivulet running through it. This place, Mr. Paddock says, was presented to the merchants of Mogodor by one of the emperors (shareefs), and it contained, besides vegetables, some trees and shrubs affording a little fruit. "The dreariness of the neighbouring country made this little spot delightful. There was a house in it, which, though a small one, was sufficiently large to accommodate a large party, who commonly met about noon to partake of a cold dinner, and returned home towards evening. From what I discovered among my friends, these convivial assemblies were productive of some good. The English and French were then at war, but the subjects of both these great nations joined in these parties in the garden, as well as other convivial meetings; and during the nine weeks that I frequented this mixed company, I never heard one political subject discussed. Consul *Gevin* told me, that each party showed the same desire, in company, to avoid every observation on the subject of home concerns, which related to the contentions between the two governments."

At two leagues to the southward of Mogodor, under Cape Sem or Teyent, is a rocky bank, stretching two leagues off, and upon which, at a league from shore, has been found 13 fathoms; at two leagues, 20 fathoms, rocky ground; at 3 or 4 leagues, 35 and 40 fathoms, oazy sand. Hereabout the current sets violently to the southward.

At about nine leagues from the coast, in the latitude of $35^{\circ} 45'$, is the *Cleveland Reef*, which is described, with the other dangers, in a subsequent portion of this work.

From MOGODOR to CAPE TEFELNEH the coast trends nearly S.W. [$S.S.W. \frac{1}{2} W.$] 12 leagues. The Cape is high and steep, and is bordered with rocks that stretch out to some distance. There is anchoring ground under it, on the South, affording shelter from East and N.E. winds, in 10 fathoms, sand. From Cape Tefelneh to Cape Geer, the distance is 6 leagues.

CAPE GEER to AGADEER, or SANTA-CRUZ.—From Cape Tefelneh to Cape Geer, the coast is a sandy beach, with a double land, which, in some places, is very high. Cape Geer is very remarkable, and may be seen 3 or 4 leagues off. To the northward of the cape, about 4 miles within land, stands a round hummock, which is a mark for the cape, and the land farther to the northward is still higher; but, on approaching the cape, no land will be seen to the southward of it. From the North side of the cape, a reef extends to some distance out to sea, and should not be approached nearer than in 20 fathoms of water.

The town of Agadeer, or Santa-Cruz, stands at about 5 leagues south-eastward of Cape Geer, at the bottom of the bay of the same name. This is the last port of Marocco on the Atlantic Ocean. The town, which stands on the summit of a mountain, is strong by nature, and its walls are defended by batteries; but the principal battery is at a short distance from the town, down the mountain, and was originally intended to protect a fine spring of fresh water, close to the sea. This battery also commands the approach to the town, both from the North and South, and the shipping in the bay. The town, called by the Portuguese *Fonté*, still remains at the foot of the mountain; and the arms of that nation are yet to be seen in a building erected over the spring.

The bay is considered as the best road for vessels on the coast of Marocco, being large and well-sheltered. It abounds in fish, immense quantities of which are caught by the inhabitants of the town, and prepared in ovens for transportation to the interior. Owing to the jealousy of its government, Agadeer has ceased to be a place of trade; yet it was formerly the centre of a very extensive commerce, whither the Arabs, and the people of Soudan, resorted to purchase merchandise, for the markets of the interior of Africa; and caravans were constantly passing to and from Tembuctoo.

Between Cape Geer and Agadeer, at 6 or 7 miles from the latter, above a point stretching into the bay, is a good anchoring place, with from 20 to 12 fathoms. In sailing from Cape Geer to the Road of Agadeer, be sure to run along by the land of the cape till you are before the castle, because northerly winds are very prevalent here; and should you keep too far from shore, you may be forced to fetch it up again with difficulty. If coming in by night, approach no nearer than in 12 or 14 fathoms.

To anchor in the Road of Agadeer, enter the bay so far that the castle may bear N.N.E., and the storehouses E.N.E. Here you will be to the southward of a rocky ledge, lying off the town, in 7 or 8 fathoms of water. The best riding is with Cape Geer bearing North, in 6 or 7 fathoms. Care must be taken to have your anchors ready; your small bower is always to be laid out before the land-wind, and the others to seaward; the sheet-anchor must also be in readiness, and brought out to the S.W. against a storm, which is soon perceived by the rising and swelling of the sea. It is likewise necessary to keep the foresail to the yard, that you may defend yourself the better, should you happen to be driven from your anchors.

On the COAST OF SUSE, southward of Agadeer, there is no port frequented by shipping; but Mr. Jackson has emphatically stated that, "there is a tract of coast which holds out great encouragement to commercial enterprise, and secure establishments might be effected upon it, which would amply remunerate the enterprising speculator. The people of Suse are, also, well disposed towards Europeans, particularly the English; and the communication and short distance between this place and the provinces, or districts, where most of the valuable products of Barbary are raised, render it peculiarly adapted to trade."

From Agadeer southward, the authority of Marocco lessens, and the Wedinoons proudly boast their independence.

WEDINOON, or Noon, on the river Akassa, (latitude $28^{\circ} 17'$ *) is a kind of intermediate depôt for merchandise on its way to Soudan, and for the produce of Soudan going to Mogodor. Gums and wax are produced here in abundance; and the people, being independent, indulge in the luxuries of dress, and use many European commodities. A great quantity of gold-dust is bought and sold here. They sometimes trade to Mogodor, but prefer selling their merchandise on the spot, being unwilling to trust their persons and property within the territory of Marocco. With Tembuctoo, however, they carry on a constant and advantageous trade, and many are immensely rich. They also supply the Moors of Marocco with convoys through the desert to Tembuctoo.†

There are but two roads fit for shipping between Agadeer and Cape Boiador, an extent of coast for the most part desert, and occupied by various tribes of Arabs, who have emigrated from the interior, and pitched their tents wherever they could find a spot affording pasture. All along this dangerous and deceitful coast, there are rocks even with, or very near, the surface of the water, over which the waves break violently, and the rapidity of the currents, which invariably set in towards the land, too often drive vessels a-shore. See the observations on Currents, page 97.

* Misprinted $27^{\circ} 17'$ on page 14.

† To those who wish for farther information on this subject, we cannot too strongly recommend the valuable work by Mr. Jackson, already quoted.

When a ship is stranded, and the crew compelled to surrender to the Arabs, the latter take every thing portable from the vessel in boats: and then, if the sea do not dash it in pieces, they set fire to it, that it may not serve as a warning to other ships which may be so unfortunate as to follow the same course.

Mr. Jackson has communicated a stratagem by which a ship was, a few years since, saved on this coast. The vessel was stranded, and one of the crew, being a Spaniard, who had been used to fish there from the Canaries, advised the captain to let go an anchor, as if the vessel were riding, and in safety. Some Arabs coming on board, the captain told them to bring their guns and other produce, for that they were come to trade with them, and were going away again in a few days. As it happened to be low water, the vessel, on the return of the tide, floated; they then weighed anchor, and set sail, to the great disappointment of the people on shore.

Of the vessels wrecked, from time to time, on the coast of the desert, many are probably never heard of; and, if any of the crew survive their hardships they are induced, seeing no prospect of emancipation, to become Mohammedans, and nothing is afterwards known or heard of them: the vessel is supposed to have foundered at sea, and all passes into oblivion.

It has been stated that, there were about 30 vessels, of different nations, the greater part English, lost on this coast between 1790 and 1806, part of whose crews found their way to Marocco, and gave some account of their catastrophe; of the remainder, a number were subsequently ransomed; but the majority were either lost, or dispersed in various parts of the desert, after a lapse of time, in consequence of the consul's making no offers sufficiently advantageous to induce the Arabs to bring them to Mogodor.

Upon this subject we find the following passages in *Mons. Golberry's Travels in Africa*:—"These Moors undertake very long journeys, crossing the deserts in every direction. On the banks of the Senegal and Niger they make prisoners of straggling or shipwrecked individuals, whom they convey towards the Mediterranean, and sell for slaves.

"The tribes of Moors who constantly trade with us in the Senegal are three in number, distinguished by the names of *Trarshaz*, (Tarassas of Jackson,) *Brachknaz* and *Woled El Haghi*, or *Darmanko*.

"Discontented individuals of these three tribes have formed themselves into a horde, who live by pillage and rapine. They traverse the coasts from the Senegal to Cape Boiador, and make a trade of watching for shipwrecks: their spies, who are dispersed along the coast to the distance of more than 100 leagues, correspond with each other by means of signals; and, when a vessel, which they often lead astray by perfidious marks, imprudently approaches land, and runs aground, these savages immediately plunder it, seize on the unfortunate crew, make them captives, and treat them with disgusting barbarity; or else they sell them to the neighbouring hordes, by whom they are conveyed, in a state of slavery, to Marocco.

"This horde is designated the *tribe of thieves*, and do not blush at this odious denomination.

"The administration of the Senegal made annual presents to the chief of this banditti, whose rendezvous was in the oasis of Gualata, to induce them to save individuals wrecked on the coasts, and bring them to the Isle of St. Louis. For each slave made in this way, it is added, the English gave a bounty of ten guineas."

WRECK OF THE SHIP CHARLES, 1810.—In the year 1816, was published, "The Narrative of Robert Adams, a sailor, who was wrecked on the Western Coast of Africa, in the year 1810; was detained three years in slavery by the Arabs of the Great Desert, and resided several months in the city of Tembuctoo. With a map, notes, and an appendix:" 4to.

From this work we learn that, the American ship, *Charles*, John Horton, master, sailed from New York on the 17th June, 1810, being laden with flour, rice, and salted provisions, and bound to Gibraltar. In twenty-six days, the vessel arrived at that place, where the cargo was discharged. She lay at Gibraltar about a month; and, after taking in sand-ballast, 68 pipes of wine, some blue nankeens, and old iron, proceeded on her voyage, the captain stating that he was bound to the Isle of May, for salt; but afterwards it appeared that he was going on a trading voyage down the coast. When they had been at sea about three weeks, Adams heard two of the crew, who were old sailors, Digitized by Google

and who had been on the coast before; speaking to the mate, stating their opinion that the captain did not know where he was steering: the advice was disregarded, and they had to beat against contrary winds for eight or nine days afterwards; and, on the 11th of October, about three o'clock in the morning, they heard the breakers; when Matthews, the man at the helm, told the mate, who was keeping watch, that he was sure they were near the shore; to which the mate replied that, "he had better mind the helm, or his wages would be stopped." An hour afterwards, the vessel struck; but there was so much fog that the shore could not be seen. The boat was immediately hoisted out, and the mate with three seamen got into it; but it instantly swamped. The four persons who were in it swam, or were cast ashore by the surf; soon after, the sea washed off four or five more of the crew, including Adams; but, as most of the ship's company could swim, they all reached the shore. When morning came, it appeared that the ship had struck on a reef of rocks, extending about three-quarters of a mile into the sea, and were more than 12 feet above the surface at low water. The place, according to the captain's reckoning, was about 400 miles to the northward of Senegal. Soon after break of day, they were surrounded by thirty or forty Moors, who were engaged in fishing on the coast, by whom Captain Horton and the ship's company were made prisoners. The vessel bilged, the cargo was almost entirely lost; and what remained of the wreck was burnt by the Moors, for the copper-bolts and sheathing; but, as they had no tools wherewith to take off the copper, they saved little more than the bolts.

"The place, which was called *El Gazie*, was a low sandy beach, having no trees in sight, nor any verdure. There was no appearance of mountain or hill; nor (excepting only the rock on which the ship was wrecked) any thing but sand as far as the eye could reach. The Moors were straight-haired, but quite black; their dress consisted of little more than a rug or skin round their waist, their upper parts, and from their knees downwards, being wholly naked. The men had neither shoes nor hats, but wore their hair very long: the women had a little dirty rag round their heads, by way of turban. They were living in tents, made of stuff like a coarse blanket of goats' hair and sheep's wool interwoven; but some of them were without tents, until they made them of the sails of the ship; out of which they also made themselves clothes."

The Moors stripped all the crew naked; and their skins, by being exposed to a scorching sun, were dreadfully blistered. The captain was soon taken ill; and having been provoked to shew somewhat of violence towards the Moors, they seized and murdered him. After remaining at *El Gazie* ten or twelve days, the Moors prepared to depart, and divided the prisoners among them. Adams, Dolbie, (the mate,) and Newsham, (a seaman,) fell to the share of about twenty Moors, who quitted the coast, with four camels laden with water, fish, and baggage. They travelled on foot, at the rate of fifteen miles a day, in an easterly direction, and in thirty days arrived at a place containing thirty or forty tents, where they found "a pool of water surrounded by a few shrubs, which was the only water they had met with since quitting the coast."

The subsequent adventures of Adams, &c. are irrelevant to our purpose. We, therefore, only add, that he was ultimately sold at Wed-inoon, and was ransomed thence by Mr. Joseph Dupuis, the British consul at Mogodor. Being unwilling to come to England, Mr. Dupuis sent him to Tangier, whence he passed over to Cadiz, where he arrived on the 17th of May, 1814, making three years and seven months since he was wrecked. Circumstances afterwards brought him to London, and the result has been the narrative, by Mr. Simon Cock, to which we owe our knowledge of these facts.

WRECK OF THE BRIG COMMERCE, 1815.—"The American brig Commerce, Jas. Riley, master, sailed from Gibraltar for the Cape Verde Islands, on the 23d of August, 1815. Soon after the vessel had left Cape Spartel, the weather became so foggy that scarcely any observations could be taken; and to this cause are referred the errors in the reckoning, which produced the loss of the vessel. Some doubts arising in the mind of the master, when, by the log, he judged himself to be about thirty miles north of Cape Boiador, he was induced to determine hauling off to the N.W.; but, before his orders could be executed, breakers were heard under the lee. He, in vain, attempted to stand off; the vessel was carried by a current and the sea directly towards the breakers; she, consequently, took the ground: surge after surge came on, and she was driven, notwithstanding anchors, which had been let go, partly with her head on shore, where she struck with such violence as to start every man from the deck. It afterward proved that, the scene of this calamity was near Cape Boiador, and there can be little doubt that the brig had been carried to the southward by the current. As the vessel

soon began to fill with water, and seemed in momentary danger of going to pieces, the long-boat was quickly hoisted out; some of the articles, most valuable, under present circumstances, were placed in it, and the crew, with difficulty, reached the shore. They had scarcely landed, and began to secure their effects from the sea, when a human figure, whose complexion was between that of a negro and of an American Indian, made his appearance: his form and face are described as hideous. Some women and children soon joined him; and, feeling themselves strong, they commenced an indiscriminate plunder. Riley and his crew had no fire-arms, but might have defended their property with pikes, had they not been afraid of irritating these people, of whose numbers, in the vicinity, they were uninformed. Such, however, was the effect produced on them by this visit, that they determined to regain the wreck in their shattered boat; which, after the departure of the savages, they reached with great exertions and continual bailing. Thence they saw the plunder of their effects continued on the shore, and all the articles which the Arabs did not want were consumed by fire. Riley was afterwards tempted to venture again to land, by a shew of friendship in the natives; and, having accomplished it by means of the hawser, he was there detained as an hostage while the old Arab went to the wreck; but the latter, not finding in the vessel any of the objects of his search, soon returned to the shore.

Mr. Riley was now in a most critical situation, and was menaced with instant death unless a treasure of dollars was produced from the wreck. As the noise of the surf prevented his voice from being heard by the crew, he partially made himself understood by signs, and some dollars were accordingly pushed in by means of the hawser. This booty did not act, however, as it was expected, in the way of ransom, and the captain had recourse to another device, more crafty than honourable. He had on board an old man, Antonio Michel, (not enumerated in the list of the crew,) who, by signs from Riley, was sent on shore: and, when he arrived, he was employed by his master to point out some spots in the sand where various articles had been buried on the first landing. This fixed the attention of the Arabs, and, during the process, Riley found means to throw himself into the sea and regain the boat, which was alongside the wreck. On the discovery of his departure, poor Michel instantly fell a victim to the fury of the natives.

The boat was now the only resource for the unfortunate crew, and to that they committed themselves and all their hopes; putting to sea in this leaky conveyance, with two of their number continually baling out the water. At last, their provisions failing, and the leaks increasing to a considerable degree, they were persuaded by their captain to steer to land; which they reached with difficulty on the 7th of September, at a promontory, as they afterwards found, a little to the north of Cape Blanco. They were compelled to pass the first night on the beach, as they could discover no part of the rocks that afforded the possibility of an ascent; and, when they did gain the summit, at some few miles distance, on the following day, they beheld before them an endless plain, 'without a tree, shrub, or spear of grass, that could give the smallest relief to expiring nature.' The shock which they thus experienced is forcibly described. Towards the evening, when they were almost fainting with thirst, a light was perceived; and such were their present necessities, that, when they discovered whence it proceeded, they were willing to accept slavery under the Arabs in the Desert, in exchange for the hope of life, and a drop of water to moisten their burning tongues. They did not, however, surrender themselves during the night: but the Arabs observed them, when at some distance, in the morning, and ran towards them; when the captain, taking Mr. Williams and Mr. Savage, his mates, with him, went forwards to meet them, bowing himself to the ground before them, and, with signs, imploring their compassion. The prize of so many Christian slaves caused no small contention among the natives; and, after the captives had been all stripped to the skin, each Arab claimed those as his property whose dress he had allotted to himself. A battle, by no means bloodless, but not terminating fatally, ensued; and it was at length decided, by the arbitration of the scimitar, that Riley and Savage, with three others, should remain with one party, while the others, mounted on the bare backs of camels, were carried in a different direction by another. Of the latter no more is known, other than that Porter, one of them, was afterwards ransomed, and brought to Mogodor, and that intelligence had been received of three of his companions.

Although Riley's companions remained with one division of the Arabs, they were the property of different masters, and with them they proceeded into the Desert: still naked, nearly

nearly starved, excoriated in a dreadful degree by riding in that state on the hard backs of camels, blistered over the whole body with the intense heat of the sun, and when obliged to drive the camels, their feet were cut nearly to the bone by stones almost as sharp as gun-flints. The description of their sufferings, indeed, exceeds any thing of a similar nature which we recollect to have read of. In this state, they were driven forward with blows; and, as their masters were in great distress, from the failure of provisions and water, the captives were limited in their sustenance to such a degree as to render it wonderful that the vital spark could have been preserved. When they had proceeded to the S.E. for more than a week, they were compelled to return towards the sea by the want of water; and, during their whole journey, the abhorrence of the white men, expressed by the women, was such that they were never admitted to the tents at night, but were exposed to the hard and flinty ground, where the *luxury* of a bed of sand could not be procured, and the cold cut them to the quick.

"They had passed fourteen days in this calamitous state when they were met by two Arab merchants from Morocco, Sidi Hamet, and Seid, his brother. Riley persuaded the former, by repeated intreaties, partly by signs, and partly in the few words, in the language of which he had become master, to purchase him, and convey him to Suerrah (Mogodor). A bargain was accordingly struck for the extent of the ransom, to be paid by a friend, whom Riley represented himself to have at the city; which he did in reliance on the humanity of any of the European consuls who might hear of his captivity. He was ultimately still further successful in inducing the two brothers to embark in the speculation of purchasing his comrades also, with the view of equal reward; but this was done with the exception of a black cook. In this situation the sufferings of the party, in some measure, were mitigated, but they were still dreadfully severe. Sidi, on many occasions, evinced a compassionate disposition, but his brother was a savage in every sense of the appellation. Mr. Riley continued about six weeks in this servitude, journeying to the north, in a line nearly parallel to the sea, and, in some places, near the shore; perpetually reminded, even by Sidi, of the forfeit of their lives, in case the expectations of their purchasers should not be realised. Several attempts were also made to intercept them or steal them away, by parties of the Arabs. On the 19th of October, they first arrived in the habitable country of Wedinoon, in Lower Suse, where Riley was supplied with some scraps of paper, on which he contrived to write a letter, addressed to the consuls of the English, French, Spanish, or American, nations. Sidi Hamet went forwards with the letter; and, after a suspense of eight days, an answer was returned by a Moor in the confidence of Mr. Willshire, the English consul, Sidi having been detained at Mogodor.

"The eighth day of my master's absence passed tediously away, when, after dark, we heard a trampling outside the walls; Seid went forth to learn its cause, and soon returned with Sidi Mohammed, followed by a well-looking Moor:—they came directly to that part of the yard where we were sitting on the ground, trembling with apprehension and with cold. When they came near us, the Moor called out, and said in English, "How de-do, Capetan?" This raised me and all my men from the ground; I felt as if my heart was forcing its way up into my throat, and it entirely obstructed my breath. I eagerly seized his hand, and begged to know who he was, and what was my doom; and if Sidi Hamet had come back: he then asked me, in Spanish, if I spoke that language, and being answered in the affirmative, he informed me in Spanish, that he came from Mogodor, that my letter had been received by one of the best of men, an Englishman, who was his friend, and who had shed tears on reading my letter; that he had paid the money to my master immediately, and had sent him (the Moor) off, without giving him scarcely a moment's time to take leave of his wife, and that he had been on his mule ever since he left Suerrah, travelling on as fast as possible, night and day. The anxiety of my companions, by this time, had risen to such a pitch, that they broke in upon his story, on which I communicated to them the thrice welcome and happy intelligence, that we had a friend who would redeem us from slavery. Our souls were overwhelmed with joy, and yet we trembled with apprehension lest it might not be true; at this moment, however, the Moor handed me a letter: I broke it open: but my emotions were such, that it was impossible for me to read its contents."

The letter, which was read by Mr. Savage, realised all their hopes, and dispelled all their apprehensions. The Consul had not hesitated to advance the money at his own risk: and, as well by his letter as by his subsequent reception of his fellow-Christians,

he shewed how completely he entered into the spirit, as well as the profession, of our faith. Every thing that humanity could dictate was done for the miserable sufferers.*

WRECKS OF THE OSWEGO, MEDUSA, &c.—Soon after the appearance of Mr. Riley's publication, from which the above particulars have been abstracted, another and similar volume appeared, describing the shipwreck of the *Oswego*, Judah Paddock, master, on the African coast, to the westward of the Canary Islands. In the month of January, 1800, this ship, of 260 tons, sailed from New York for the port of Cork, with a crew of thirteen persons. Having performed this voyage, and discharged his cargo, the Captain determined to ballast his vessel, go to the Cape Verde Islands, and take a load of salt, skins, &c. for New York. From ignorance of the current setting on this coast, it happened that, on the 3d of April, without *any particular stress of weather*, the vessel struck, during the night, on the coast of Barbary, somewhere near Cape Sabi, or between the parallels of 27 and 28 degrees. It was the wish of the master to stay by the wreck, until preparations could have been made for a voyage in the long-boat, and it seems that such an attempt would have afforded a fair prospect of success; but his intentions were frustrated by the obstinacy of some of the crew; and the whole party went ashore in the boat, without provisions or water.

From this time the conduct of the crew, or, at least a part of them, seems to have been highly censurable, and they were consequently captured by the Arabs, at a time when their means of escape appeared to have advanced. They underwent the same species of suffering described by Captain Riley. The captivity took place on the 6th of April; and, on the 27th of the same month, the party had reached an inhabited and cultivated country, having many days of rest from travelling in the interval. A bargain was early struck with Ahomed, the chief of the tribe, for a price of ransom, on reaching Suerrah, or Mogodor, and they, at length, arrived at Agadeer, or Santa Cruz, and thence, on the 10th of May, they came in sight of Mogodor, where the British Consul did all that humanity could suggest both for Mr. Paddock and his companions, and procured the release of him, and of those who had travelled with him, from the miseries of slavery.

It appears probable, from Captain Paddock's narrative, that the vessel had been set considerably to the eastward before she reached the parallel of Cape Finisterre, but the great error, in her reckoning unquestionably occurred subsequently thereto. In the parallel of Madeira it was, however, supposed that she was, or might be, to the *westward* of that island: but the vessel, according to observations for latitude, was generally a-head of her reckoning, and in the night of the 3d of April, she struck on the coast, as above mentioned, upon a reef of hideous rocks. With great difficulty the people landed, by crawling over slippery rocks to a sand-bed, "beyond which appeared a high hill, upwards of 100 feet in altitude." Captain Paddock says, "On the morning of the 4th of April, as soon as the day began to dawn, I ascended the high mountain of sand, and there remained till near sun-rise. What could I see? A barren sand, without either tree or shrub, or the least appearance of vegetation; dreary in every respect; and, at a distance back, a long range of mountains extending east and west." It was next found, by a compass, that the shore extended nearly east and west, and at 10 or 12 miles to the westward a cape projected into the sea, in form of a very square bluff. It seems that the captain had very inaccurate charts; he could not determine the place of the wreck, but supposes it near Cape Sabi, which we represent in 28° 10' N.; and adds, we must thus have been currented eastward more than 200 miles since speaking an English frigate off Cape Finisterre. The country in the vicinity of the wreck was wholly sandy, and at about 8 miles to the south-eastward had every appearance of once having been the bed of the sea.

On proceeding towards the north-eastward, the crew arrived at a fine sandy bay on the coast, which is probably the *Porto Cansado* of the Portuguese, as shown on our charts. It has 9 or 10 feet within a cable's length of the shore. The distance across it was estimated at about three miles: the two outer points are broad, closing to within one mile; a ledge of rocks on each point leaving a fair entrance of half a mile in breadth,

* The Volume, from which these particulars have been extracted, was published in London, 1817, at the price of 36s. It comprehends, however, an account of Tembucoo, and much interesting information relative to the interior trade and condition of Africa.

with deep water. "Against those ledges the sea broke violently, but in the harbour it was smooth: from the windward side of the harbour a ship might lie very well, with the wind as it then was, which blew strong four points on shore or at North-east. Had our situation been less deplorable, I should have been led to examine this fine-looking harbour more particularly. Should any national vessels ever undertake to survey this coast, they will, beyond doubt, visit it. From our judgment, being on shore, it would appear, from the offing, a nearly straight shore, as the two outer points, or chops, of the harbour would, except being near in, seem nearly to close on the western side of the harbour. Where we stood to look at it, the bank was high, and from sea-board would, in my opinion, appear like a high round knoll; the mountain back, only a few miles distant, would appear black, at least of a dark colour, and the top flat for several miles each way, running E.N.E. and W.S.W." On this nearly flat mountain, supposed to be nearly 400 feet in height above the level of the sea, is a remarkable bed of salt, about a mile in diameter. Hundreds of ships can ride in the harbour in safety, defended from all winds except the north-west; and, as the entrance is so much narrower than the body of the harbour, no sea through that gut can hinder ships very much, the ground being perfectly clear.

Captain Paddock adds, a survey of this coast, if done in the summer season, would neither be difficult nor attended with risk, provided there were employed two or three fast-sailing small vessels, furnished with good cables and anchors. There is a great number of anchoring places along the coast at sea-board; and, although those situations are very rough, yet in that respect they are nothing in comparison to the anchorage on the grand bank: and, should a cable happen to part, or circumstances make it necessary to be cut, there would be no risk of going ashore; for, when I was on that coast, a vessel might be within two or three points of lying directly off shore. I learned from the Arabs that the Spanish fishermen frequently anchored near it, and by signs from them came ashore and traded with them, giving fish for skins, or for sheep's wool. In carrying on this trade, the plan they adopted for their own security, as Ahomed once related to me, was this: "We approached, he said, to the sea-side with our goods, and left one man with them, all the others returning back out of the reach of gun-shot. The Spaniards then landed, and made their agreement with this one man, he keeping himself so far from them as not to be within reach of their grasp, always ready for a start, and having full confidence in his heels." Ahomed acknowledged that this trade was conducted fairly by the Spaniards. According to his representation, they often lay at anchor within a cable's length of the shore.

"Happy would it have been if, fifty years ago, a good survey of this coast had been made and published to the world. A delineation of the very strong currents, especially, might have saved a number of fine ships and a great many valuable lives. While I was in Mogodor I examined a great number of protests, made by masters or other officers upon oath, relating to ships that had been wrecked on that coast, and all of them attributed their losses to the currents that had swept them away, most of them to a great distance from the place where they had calculated their ship to be. *Not one of these ships was protested to be lost by stress of weather.* Indeed, there is no doubt, in my own mind, that many missing ships, carried by the currents along this inhospitable coast, have been wrecked and never more heard of. A vessel, in coming in here, seldom meets with any shoal or rocks to strike on, till it strikes upon one of the many square and perpendicular bluffs, against which the sea beats with such violence that it must go to pieces in a very few minutes, and every soul inevitably perish. This circumstance, viewed in connection with the great quantities of pieces of wrecks scattered along that coast, is sufficient, I think, to support the opinion which I have advanced."—(Paddock's Narrative, pp. 19, 340, 1, 2.)

Since the above was written, we have received the affecting narrative of the loss of *LA MEDUSE*, French frigate, on the Arguin Bank, to the southward of Cape Blanco, on the 22d July, 1816; which may probably be attributed to a similar cause,—the direction of the currents. It has been justly observed that, the annals of naval distress do not offer a more terrible instance of shipwreck. *La Meduse* sailed, 17th June, 1816, from the Isle d'Aix, under the command of *M. de Chaumareys*, having on board 240 persons; of which the greater portion consisted of soldiers intended to garrison those forts, at the mouth of the Senegal, which had been restored by the treaty of peace: they were accompanied by the newly-appointed governor of that place.

The ship ran aground on the bank, in the parallel of $19^{\circ} 36'$. A great consternation ensued: and, after many angry deliberations, it was resolved, as they had only six boats on board, to break up the vessel, and with its materials construct a raft large enough to place the soldiers on it, who were thus to be towed ashore.

On the 5th of July, the embarkation from the wreck took place, in the greatest confusion. One hundred and forty-seven persons, (including the Captain and Surgeon,) were confided to the raft. The precipitation with which it was built prevented its being fitted with railings. It was about 60 feet long; and if solidly put together, would have been able to bear two hundred men: but it was weak and ill-constructed, without sails or masts. There were placed upon it a number of quart-measures of flour, five barrels of wine, and two casks of water.

"Scarcely had fifty men set foot on the raft, when it sunk at least two feet. To facilitate the embarkation of the rest, all the flour was thrown into the sea: the wine and water alone were preserved. With the whole number on board, the raft was sunk at least three feet, and so closely were they huddled together, that it was impossible to move a single step. Fore and aft the water was up to the middle of the unfortunate sufferers.

"It had been settled, that all the boats of the frigate were to tow us, and the officers who commanded had sworn that they would never abandon us. The boat in which the governor was, threw to us the first towing-rope. If all the efforts of the boats had constantly acted upon us, favoured as we were by the sea-breeze, we should have reached land in less than three days, for the frigate was not wrecked more than 12 or 15 leagues from the shore."

By the boats, however, the raft was inhumanly abandoned: it was thus left to its fate, amidst all the horrors of famine. In an element which already covered one half of their bodies, the greater part of those upon it at once yielded to despair.

For twelve days this was the condition of the survivors: we say *survivors*, because during this time, the number rapidly diminished.

In the first night the wind freshened, and there was a considerable swell of the sea: the people tumbled over each other; and, in the morning, ten or twelve were found dead, with their lower extremities entangled in the interstices between the planks of the raft: others had been carried off by the sea. Day passed away, and a night succeeded more dreadful than the former; many perished. In the morning many others gave themselves up for lost, and fell to drinking until they had lost their reason. A mutiny ensued. The captain was thrown into the sea, but recovered by the officers and passengers. In the night many soldiers appeared to be mad: a battle took place, and the morning discovered that sixty-five men had perished.

The recital thus describes the melancholy events of the twelve days; during which time a principal portion of sustenance was derived from the bodies of deceased companions! At this period only fifteen men remained, and these were happily discovered and taken off, on the 17th of July, by the *Argus*, French brig, which restored them to their country.

Other instances of ships lost upon this coast might be given; but those selected will be sufficient for our purpose.

CAPE BOIADOR TO CAPE BLANCO.—The tropical regions of the African coast, between Cape Boiador and Cape Blanco, present to contemplation the *Sahara*, considered as the most extensive Desert on the Globe. This Desert consists of inadhesive sands, which are driven about by the winds, and chiefly by those from N.E. by which they are disturbed and carried to an astonishing distance. This circumstance has been noticed by Mr. Luccock, and we have met with other notices to the same effect in MS. Journals. Of the merchant-fleet, from St. Helena, under convoy, in November, 1813, most of the ships had their sails covered with the *red* sand, when they must have been from 400 to 500 miles from shore, in about 27° and 28° N., after a succession of easterly winds. "I once," says Mr. Luccock, "saw the sails and deck of a vessel covered with it, when 400 miles from the coast, and have heard of the same phenomenon being remarked at a far greater distance. This moving expanse of sand was probably, at some anterior period, a large inland shallow sea, communicating with the Mediterranean by the Syrtes, [Gulf of Sydra]" &c.

CAPE BOIADOR, is represented by the *Chev. de Borda* in lat. $26^{\circ} 12\frac{1}{2}'$, as shown in page 14, but a late survey exhibits it $26^{\circ} 9'$ only, whence it may be assumed as a little to the southward of the position before assigned. The cape has some rocks about it, but on its south side is a bay affording anchorage in 4 and 5 fathoms, and ships may anchor farther out in from 15 to 20 fathoms, within a league of the shore, on a bottom of sand, broken shells, &c.*

GARNET BAY.—At the distance of 28 leagues S.W. $\frac{3}{4}$ S. [*S. by W. $\frac{1}{2}$ W.*] from Cape Boiador, in lat. $24^{\circ} 47'$ is the small bay, called *Garnet Bay* [*Angra dos Ruivos* of the Portuguese] which abounds with cod, bream, hake, and various kinds of other fish. The coast between Cape Boiador and this bay is, in general, high and rugged, but with soundings, at a league from shore, of 20 and 30 fathoms. Two leagues to the southward of Garnet Bay, are seven small table hills, called the *Seven Capes*, which serve as an excellent mark for the coast.

RIO DO OURO, or GOLD RIVER.—The entrance of this river lies at the distance of 27 leagues S.W. by W. $\frac{1}{4}$ W. [*S.W. $\frac{1}{2}$ S.*] from the Seven Capes. There is good fishing here, but the entrance of the river is shoal and dangerous.

At eleven leagues to the southward of the Rio do Ouro is the Bay of Cintra, which forms a harbour for the night, to the fishing vessels of this coast. The bay extends three leagues, from N.N.E. to S.S.W. but reefs extend both from the North and South Points. That from the north point extends a league to the southward, and the sea breaks heavily over it; and there is, also, a rock near the middle of the entrance, which breaks in blowing weather. A remarkable peaked sand-hill bearing S.E. by E. [*E.S.E. $\frac{3}{4}$ E.*] leads into the bay; the coast of which is low and sandy, and it has good ground, but exposed to the west.

The Bay of St. CYPRIAN, within Cape Barbas, lies in latitude $22^{\circ} 20'$, and 15 leagues to the southward of that of Cintra. It has good ground; but Cape Barbas, on the west is very foul.

On all this coast no water is to be found, excepting in Rio do Ouro.

CAPE BLANCO.—A remarkable sand-hill on Cape Blanco is situated, as shown in page 14, at about 30 leagues to the southward of Cape Barbas. The cape itself has been described as dry, barren, and uncultivated; dangerous to approach, and containing no fresh water. The Sailing Directions, however, state that, "there is nothing to avoid but what may be seen; that there is no cause to be alarmed by the prodigious roaring of the sea, as it is produced merely by the shooting of the streams against each other."

To the southward of the Cape is a shoal, called the *Bayadere Bank*, having on its shoalest part, $5\frac{1}{2}$ fathoms. Near it are 8 and 10 fathoms, sandy ground, with an excellent fishery for cod, bream, soles, &c. At 9 leagues W.S.W. from the cape the depth is about 34 fathoms, and the water thence gradually shoalens to the East and E.N.E.

CAPE BLANCO to Portendic.—We now arrive at the Bay of Arguin, to the South-eastward of Cape Blanco. This bay, which contains many shoals, also abounds with fine fish, particularly with that species of cod-fish, called the Old Woman, or *Düke Stockfish*, some of which weigh as much as 200 pounds. This fish is dried, salted, and prepared, in every respect, the same as the cod of Newfoundland; but does not keep longer than 6 or 7 months. The Dutch were formerly engaged in this fishery, from January to July; the salt being purchased of the Moors, at Cape St. Anne, where there are extensive natural salt-pits. The products of the fishery have latterly been sold on the Coasts of Guinea, and at the Canary Islands.

The best kind of turtle, namely, the green kind, also abounds in the bay during the whole year. These have been little sought for, although very acceptable in the Senegal.

The navigation within, or to the eastward of, Cape Blanco appears to be too intricate to be understood from mere description, or to admit any other than small vessels. Cape Myrick, or Mirik, lies at the distance of 30 leagues South [*S. by E. $\frac{3}{4}$ E.*] from Cape Blanco, and between these capes is the great bank of Arguin, with its numerous shoals. There is a broad channel between this bank and Cape Blanco on the North, as well as

* The Bank of Soundings off the coast between Cape Boiador and Cape Blanco is well represented in the late charts. See, particularly, the Chart of the Coasts from Gibraltar to Cape Blanco, published by Mr. Laurie.

between it and Cape Myrick on the South. The southern part of the bank is dry at low water. In the channel, on the north, are 10 and 11 fathoms of water, but a dangerous shoal lies in the middle of it, and ships proceeding inward keep near the land, the south point of Cape Blanco being clean. From Cape Myrick, a bank stretches westward, two leagues into the sea. The land to the southward of Cape Myrick may be readily known, as it is distinguished by seven hillocks between it and Tanit Bay. Three leagues to the North-eastward of Cape Myrick is the Bar of the River of St. John, which will be presently noticed.

ENGLISH GUM TRADE.—The Dutch have the credit of being the first who introduced the Gum Arabic, commonly called Gum Senegal, into Europe, in the early part of the 17th century, when they carried on the fishery in the Bay of Arguin. The French merchants of Bordeaux and Nantes, first brought it, however, into general repute, and decided its superiority and purity to the gums of the East. From 1760 to 1779, England possessed the Senegal, and the trade for the gum; and by the treaty of Versailles, 1763, reserved to herself the exclusive possession of this commerce, which she protected and maintained. The English demolished the forts and establishments at Portendic and Arguin, which had been formed in 1724 by the old India Company of France, in order to bring the whole of the gum of the African forests into the River Senegal. In 1779 the French obtained re-possession of the Senegal; but, by the treaty of 1783, it was agreed that the English should have the liberty of carrying on the Gum-trade from the mouth of the *River St. John*, to the bay and port of *Portendic*, inclusively; provided that they should not form any permanent settlement, of what nature soever, in the River St. John, or the bay of Portendic. The treaty is still in force, as no alteration of it was made by the treaty of 1814; which merely stipulated the engagement of the English Government to restore to France, in full right and sovereignty, the possessions of Senegal and Goeree. The transfer took place in 1816, when the English withdrew to their other settlements on the coast; leaving the gum-trade entirely in the hands of the merchants of Senegal, although they possessed an indisputable right to the trade from the Bay of Arguin to the Bay and Port of Portendic.

At the commencement of the year 1821, the British merchants of the Gambia obtained the support and assistance of the local government in the attempt to renew the gum-trade at Portendic, and revive that friendship and good-will which formerly subsisted between them and the Moors in Senegal. Commodore Sir George Collier was solicited to order a vessel of war for the protection of the trade, and to convey presents to the Chiefs of the Trazzarh or Tarassa Moors; and for this purpose his Majesty's gun-brig *Snapper*, commanded by Lieut. T. Evans, was selected, and directed to proceed on this important service. The *Snapper* sailed from Sierra Leon on the 18th of February; and, after visiting the River Gambia, and making those arrangements which were requisite, arrived at Portendic on the evening of the 5th of April, for the purpose of negotiating, &c.

PORTENDIC is the lat. of $18^{\circ} 19' N.$, and long. $16^{\circ} 10' W.$ of Greenwich. There is a bar or tall palm or date tree just above the beach which marks its site, and is very remarkable, there being no other on that part of the coast; for a vessel coming in to anchor, this tree ought to bear N.E. by E., which leads to "*Waterman's Bay*," distant about two miles from the tree. This bay is by far the best and safest place for merchant-vessels to come to for anchoring, at about one mile from the shore, in 4 or 5 fathoms, with the tree bearing N.E. by E. as above stated. There is less surf in this little bay, than in any other spot hereabout, and the trade, which is always carried on by the Moors afloat, may be managed there with great facility, safety, and advantage. The whole coast to windward of Senegal, has the most dreary and barren appearance; nothing but sandy hillocks, and low bushy trees, thinly scattered, are to be seen.

The *Angel's Paps*, represented on the chart, are two sand-hills of moderate height, which serve to distinguish the coast to the northward of the bay of Portendic. This bay, or rather cove, is very uneven, and the sea in it is rough during a part of the year. It is described as clean, and having from $4\frac{1}{2}$ fathoms water, fine sand, at the entrance. to $2\frac{1}{2}$ very near the shore. To the southward is the cove of Little Portendic, in latitude $18^{\circ} 0'$. These coves may be readily known, there being no others like them on the coast. They abound in fish, and contain the same kinds as those of the Bay of Arguin.

Fresh water is here scarce and dear, as it can be procured only at a great distance up the country, from the Moors.

SENEGAL, &c.—From Santa Cruz, Tenerife, to the River Senegal, the *true* course is S.S.W. to latitude $18^{\circ} 30'$, before a ship hauls to the eastward. This is in order to avoid being set by the current too far to the eastward, or on the banks of Arguin, &c., which would take any ship up at a great distance from shore. From the above-mentioned latitude haul to the eastward, so as to make the land in about $16^{\circ} 30'$, when you will probably see some palmetto-trees, the most remarkable on this coast; the land to the southward being low and barren, with very few trees.

If standing in for the land by night, heave a cast of the lead every hour, as you fall into soundings all at once, 50 fathoms close to the edge of the bank, at the distance shown by the Chart, or about 8 leagues from shore, and thence shoaling to 8 fathoms at a mile and a half from it.

The Road of Senegal is off Barbary Point, lying in the position shown in the Table, page 14. The ground is good, but the waves run very high.

In this road, all vessels which draw more than 10 or 12 feet of water must come to anchor, but those of less draught may pass the bar, and enter the river.

An inconvenience attending the roadstead is, that there is not (unless recently erected) any mark which points it out; and the coast, being extremely low near the entrance of the river, affords no object by which it may be discovered. The flag-staff of the fort, on the Isle of St. Louis, in the river, may, however, be seen over the low land. This fort is in lat. $16^{\circ} 3\frac{1}{2}'$, as shewn on page 14.

The bar of the Senegal is a tongue of sand, which stretches from the north side of the entrance, and the water of the river is ejected by it on the south side, and so as to break that impulsive force by which it would otherwise rush into the sea. On the bar there is never more than 12 or 13 feet of water; and this shallowness is not the only inconvenience; the passage being rendered very difficult and dangerous by breakers, which set on with great violence, and occasion frequent wrecks. The current in the river sets to the southward, as already noticed on page 78, and is constantly driving a portion of sand against the bar; this obstructs the waves from the offing, which approach it with great violence.

The bar is most easily passed in the months of July, August, September, and October; but it is very rarely quite calm. On the contrary, the sea frequently breaks against it violently. The waves, which strike against it, are always united in threes, or leashes. For example, when the sea is but slightly agitated, one may perceive three waves, perfectly distinct, approach and break against the bar, immediately after each other; and these three waves appear to be, as it were, connected; for there is often a considerable interval of time between the attack of the first three waves and the approach of the succeeding trio.

During the prevalence of rough weather, this series of assault, by united waves, incessantly prevails; but then these attacks follow each other so rapidly, that the time between them is no longer perceptible. The sailors call the interval between the two assaults, when tolerably long, a *set-off*, because then the bar experiences a slight degree of rest, during which time it may often be passed: but frequently the violence of the waves is so great, and squalls succeed each other so rapidly, that there is no longer any interval between them; and, consequently, no *set-off*.

Mons. Golberry, to whom we are indebted for this description, adds, "The force and rapidity with which the waves of the same squall, and even the squalls themselves, follow each other, depend upon the general state of the wind and sea: but I have often remarked the latter to be calm at a distance, while the wind was blowing very gently, and, nevertheless, the waves continued to break with violence over the bar. I have attributed this to some convulsion of the sea at a distance, the effects of which may have extended to the extremity of this bay. After the cause of this considerable motion has ceased, the surface of the sea soon becomes calm; yet the great mass of the element preserves, for a long time, an oscillating undulation in the open sea, the effects of which are very perceptible near shore.

"When the waves from the offing proceed towards, and break against, the bar, the passage is always difficult, sometimes dangerous, and often impracticable, at least without incurring the risk of destruction.

"The waves have attained their full violence when a second or third will pass over a shallow or small vessel, fill it, cause it to sink, or make it run aground; because the last

two waves break in a semicircular form ; the third, in particular, produces this effect, and the cause of the expansion may readily be conceived.

“ The first wave which arrives does not form the semi-circle, because it meets with no obstacle from the return of the particles of that which preceded it ; and, when the attacks are separated by an interval, the first wave has time to disperse itself ; the second forms an arch, because it meets with the divisions of the former, which are returning towards the sea, and which, forming an impediment, force it to rise ; but the third wave, which at once experiences the combined obstacles of the returning waters of the first and second, can force its way only by a sudden inflation ; and, as its rapidity is occasioned by a very strong impetus, it immediately rises and forms an arch, or semicircle, the height of which is in proportion to the rapidity of the wave at the time of its contact.

“ It is, therefore, in general, this third wave which proves most destructive : the arch which it forms is so great in its diameter, as to cover a vessel completely in every direction ; and it has often happened that barks have been raised, by this impetus, perpendicularly, as it were, on the end of the keel. This effect of the power of the waves was unfortunately experienced by a cutter belonging to the corvette *Rossignol*, commanded by M. de Corneillan, a lieutenant. The vessel had entered the river, having nearly reached the middle of the bar, which this officer thought practicable, when the third part of one of these bodies of water struck it on the stern, raised the hull perpendicularly, and placed it on the extremity of its keel : it remained for an instant in equilibrium, and then overturned.

“ During my residence in Africa, there were wrecked, on the bar of Senegal, four ships and twenty-two shallops, by which a hundred and nineteen men were drowned.”

M. Golberry is of opinion, that the establishment of a signal-post, with proper marks, &c., such as he describes in his work, would obviate these dangers and misfortunes.

Almost immediately within the bar, the river has a depth of 7 or 8 fathoms. If, therefore, the bar did not exist, vessels of burthen might sail thence up to Podor, or Podhor, where the tide continues to flow, though at so great a distance from sea.*

On passing by sea within cannon-shot of the Isle of Senegal, it affords a very agreeable prospect. Fort St. Louis forms the principal object in this perspective. To its right and left extend the two parts of the town, the streets of which are well arranged ; and, in general, composed of thatched cottages or huts, interspersed with some stone houses, covered, according to the custom of this part of Africa, with flat roofs.

The woods which line the east bank of the river, appear, at this distance, to belong to the isle, and give it a cheerful and rural aspect ; but this illusion disappears on a nearer approach ; for no place can be more arid, parched, or deprived of vegetation, than the Isle of St. Louis, the soil of which is nothing but a fine shifting sand. Notwithstanding this, the population amounts to about 5000 persons. The water of the isle is brackish and unwholesome.†

The fort and village of Podor, with two other villages in the vicinity, are the places where the gum-merchants assemble, with their merchandize from the forests. At Podor, the flood-tide, on the river, appears much stronger than near the sea.

For a copious description of the gum-trade, see the *Travels* of M. Golberry, of which a translation has been published, affording most valuable and interesting details relative to all the country of Senegambia, &c.

The whole of the coast, south-westward, from the *Bar of the Senegal* to the *Bay of Yoff*, (distance 80 miles,) consists of low sand-hills, not to be seen above 3 or 4 leagues from a ship's deck. Very near the shore, at about $5\frac{1}{2}$ leagues to the north-eastward of Yoff Bay, there is a dangerous whirlpool, wherein boats and canoes have often been lost. The bank of soundings continues down to this whirlpool, and diminishes thence to Point Almadia, or the pitch of Cape Verde.

* We suspect that the peculiar agitation of the sea, near the bar, is caused, in a great measure, by the operation of the tide.—J. P.

† On the peninsula, between the Isle of St. Louis and the sea, is *Gattandar*, a moorish town, seated on a sand-hill.—It is defended by a battery on the West. The north end of this town, more properly village, is on the parallel of Port Louis, and the houses extend thence to the southward, about one quarter of a mile.

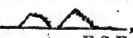
CAPE VERDE has been so named from its being covered with large green trees of the baobab species, which do not, however, keep their verdure all the year round. The cape is remarkable by two round hills, called the *Paps*, situated on its south part, towards the west. They are insulated, no other being seen near the cape; and, though of moderate size, may be seen at the distance of 7 or 8 leagues. To the N.W. the land is low, stretching about half a league in that direction; and, at its extremity, a ledge of rocks, above and under water, extend about 2 miles into the sea, from Almadia Point. The low land appears to the west of the *Paps*, from vessels to the northward; but its true bearing from them is N.W. by W.

This low land, with the coast to the north-eastward, render the Bay of Yoff very dangerous, particularly in a calm: the currents in this part, setting rapidly to the southward, have frequently driven ships to the farther end of the bay, where anchors are of no use, there being a depth of 80 and 100 fathoms very near the shore. Therefore, on approaching from the northward, with the *Paps* in sight, you are not to steer for it until it appears nearly S.E. [E.S.E.]

As two smaller hills, called the *Little Paps*, stand on the coast, at about 40 miles to the north-eastward of the *Paps* of Cape Verde, navigators must be cautious of not mistaking them for the latter. The mistake cannot, however, be easily made; because, from the coast, the *Little Paps* and Cape Verde would then most likely be in sight.

ISLAND OF GOEREE.—The island of Goeree is little better than a barren rock, rendered important by its situation. It is about half a mile long, and one-eighth of a mile in breadth. The following directions for sailing to, and description of, it have been obligingly communicated to the Editor by Mr. Stokes, master in the royal navy.

Ships from the Cape Verde Islands, bound to Goeree, should endeavour to keep in latitude $14^{\circ} 43'$, steer true East, and make Cape Verde. The first land seen will be the *Paps*, which are two remarkable round hills, bearing from each other N.W. and S.E. nearly; and, though of a moderate size, may be seen, in clear weather, from the mast-head, 8 or 9 leagues. They stand at a small distance to the southward of the cape, and

about one mile inland; bearing true East, 8 leagues, they appear thus , just above the horizon; no other land to be seen. Having made the cape, steer E.S.E. (by compass,) keeping the *Paps* one point on the larboard-bow; and, on approaching the land, Cape Manoel will soon appear, which bears from Cape Verde S.S.E. $\frac{1}{2}$ E. [S.E. $\frac{1}{2}$ S.] 10 miles, and shews a bluff point. Between the capes are the *Magdalens*, or *Bird Isles*; they stand about 2 miles from the main land, and there is a channel within them, but I had not an opportunity of exploring it.

When Cape Manoel bears true E.N.E., Goeree will open. Give the cape a berth, and steer for Goeree, giving the S.E. point a berth of 2 cables, it being rocky off that point.

There is a channel to the N.W. of the island; but, as the N.E. wind is constant here, the best way to gain the anchorage is, to turn up on the S.E. side. In standing over to the East shore, no danger need be apprehended, having from 15 to 17 fathoms, soft ground, in every part. To anchor off Goeree, the fort on the hill may bear from W. by S. to S.W. (by compass,) distant from the town $1\frac{1}{2}$ or 2 miles; 10 or 11 fathoms, sandy bottom. Small vessels anchor close in.

Goeree bears from Cape Manoel E. by N. about 3 miles. It lies in a true N.N.W. and S.S.E. direction. The South end is formed by a steep hill, flat at the top, and 300 feet high, which rises suddenly from the middle of the island, and continues to the South end, where it runs off, in a sloping point, to the sea. On the top of the hill, and over the town, stands the fort. The North part is low and narrow; on it stands the town. A low narrow tongue stretches out from the North end of the town, in a N.E. direction, 150 fathoms long, and about 20 broad; on the extreme end of which, close to the water's edge, is a strong stone battery of four 24-pounders. There is a covered communication between it and the town, and the magazine is under it. This battery is in a semi-circular form, and two guns will bear in any direction, excepting towards the town. The only landing-place, which is a pretty good one, is on a sandy beach on the East side of the town, in the bottom of a small bay, which is formed by the tongue above-mentioned, and the body of the island. With respect to the depth of water round the island, there are $4\frac{1}{2}$ and 5 fathoms, clear ground, within $1\frac{1}{2}$ cable's length, in every part, excepting the West side of the town, where there is a rocky shoal, which reaches from the shore about 3 cables' length, and its breadth is about 2 cables, with $1\frac{1}{2}$ and 2 fathoms

of water upon it. It may not be approached nearer than in 6 or 7 fathoms. For the position of Goeree, see page 14.

Mr. Finlaison (M. R.N.) says that, "Ships sailing from the Cape Verde Islands, and bound to Goeree, will strike soundings in 60 fathoms, fine sand, at 80 miles off. To anchor at Goeree, bring the fort to bear West, or W. by S. one mile off, in 7 fathoms.

"From Cape Verde to the entrance of the Rio Grande, are strong southerly currents; and from that river to Cape Sierra Leon, you will be under the influence of the regular tides."

From Cape Manoel to the *Red Cape*, on the coast of *Baol*, the distance is 4 leagues, S.E. by E. $\frac{1}{4}$ E. [*E.S.E. $\frac{1}{2}$ E.*] The *Red Cape* makes the opening of a bay, on the N.E. side of which lies the small town of *Rufisk*, where the French had a factory. To sail from Goeree to this place, run along the coast, which is low, with a sandy beach: there are some rocks, westward of *Rufisk*, stretching about a gun-shot into the sea, which may be avoided by keeping half a mile from the shore.

In the night-time, you must proceed in 17 fathoms, having sometimes recourse to the lead; the land, even in the night, will direct you sufficiently to avoid the rocks. In the season of the tornadoes, the road of *Rufisk* is not good; but, in the summer, you may safely lie there in 6 or 7 fathoms, close to the shore, if agreeable.

About $3\frac{1}{2}$ miles S.E. of the *Red Cape* lie *Cape Naze*, with a small bay between both; from the latter, the coast extends to the S.E. $\frac{1}{4}$ S. [*S.E. $\frac{1}{2}$ E.*] about $4\frac{1}{2}$ leagues, as far as *Portudal*, another French factory; and then 5 leagues S. by E. $\frac{1}{4}$ E. [*S.S.E. $\frac{1}{2}$ E.*] to *Cape Serene*; between this cape and *Portudal*, two leagues off the coast, and parallel to it, lies *Amboroo Bank*, on the south tail of which you find only $1\frac{1}{2}$ fathom. Ships that come from the westward must be cautious of this shoal; the ground is very hard upon it, and close to it is a depth of 5 fathoms.

The Road of *Portudal* is far from being good, and is fit for small vessels only; they lie close to the shore, athwart of the little houses between the cliffs. All the coast near *Portudal* is bordered with rocks, and must not be approached too near.

Three leagues S. by E. $\frac{1}{4}$ E. [*E.S.E. $\frac{1}{2}$ E.*] from *Cape Serene*, lies *Joal* or *Joula*, which is likewise a French factory: it stands on the river of the same name, at its North point, from which a shoal, with only $2\frac{1}{2}$ fathoms of water upon it, projects into the sea. The Road of *Joal* is not much better than those we have just mentioned; the entrance of the river, between *Joal Point* and the point to the South of it, which they called *Palmarin Point*, is 3 miles broad, with a depth of 3 fathoms of water in mid-channel.

From *Palmarin Point* to the northernmost of the *Birds' Islands*, the coast extends S. by E. $\frac{1}{4}$ E. [*S.S.E. $\frac{1}{2}$ E.*] 9 leagues; and from the mouth of *Salum River*, which lies 4 leagues south-eastward of the point, to the *Birds' Islands*, the shore is bordered with a sand, named the *Red Bank*, that stretches above 4 miles into the sea, and close to which are 4 fathoms of water.

From *Palmarin Point* to the pitch of *Cape St. Mary*, the distance is 13 leagues, S. $\frac{1}{4}$ E. [*S. by E. $\frac{1}{4}$ E.*] The entrance of the *Gambia* lies between the pitch of that Cape and the *Birds' Islands*.

The *Birds' Islands*, four in number, and very small, lie on the South end of the *Red Bank*, above mentioned, and at the southern mouth of the *River Salum*, on the north shore, there are 3 fathoms of water close to the edge of this tail of the bank: from these islands, the *Pitch of Cape St. Mary* bears nearly S.S.W. [*S. by W.*] $4\frac{1}{2}$ leagues, and between is the opening or mouth of the *RIVER GAMBIA*.

On the 25th of December, 1819, a flag-staff was erected, and the Union-jack displayed, on the westernmost *Bird Island*, and here reside the principal pilots for ships going up the *Gambia*.

RIVER GAMBIA, &c.—In sailing off the coast between Cape Verde and the *Gambia*, shipping must proceed with caution, as the *Amboroo Bank*, the shoals of *Joal*, and the banks in the vicinage of the *River Salum*, are dangerous, being very shoal. You may, however, approach the pitch of *Cape St. Mary* to the depth of 7 or 6 fathoms.

The cape is readily known by its making like a plain; low by the sea-side, with an acclivity towards the interior. It has (or had) two very tall palm-trees, at some distance from each other, of which the one on the highest part, or farthest inland, is the tallest, and very remarkable. There is, besides, a tuft of trees, like a small wood, to the eastward of the cape.

The Banyan, or St. Mary's Shoal, lies on the South side of the entrance, to the E.N.E. of Cape St. Mary. It is even with the water, and therefore dangerous. In the channel to the northward and eastward of this shoal, are from 10 to 5 fathoms at low water.

In coming from the northward, you ought not to approach the river nearer than in 7 or 6 fathoms, before the flag-staff on the Bird Island or Cape St. Mary comes in sight. You will then be about eleven miles from Cape St. Mary and ten miles from the flagstaff. The latter may be seen sixteen miles off. It may be advisable for a stranger not to proceed further than in 5 fathoms without a pilot, unless the vessel draws less than 12 feet of water. Those leaving Goeree, when bound to the Gambia, may steer about S.E., keeping their lead constantly going, and approaching the coast no nearer than in 7 fathoms. When near the entrance of the Gambia, the ground will generally be found an oozy sand; but, near the cape, sometimes sand and sometimes red shells will be found. The ebb in the river runs very strongly, nearly 8 hours, but the flood is not so strong. Spring-tides are very rapid.

To SAIL INTO THE GAMBIA, steer for the middle, between Cape St. Mary and the northern-shore, or Birds' Islands, till you bring the cape to bear S. by E., distant about two leagues; then keep over for the northern shore, and run in, to $5\frac{1}{2}$ and 4 fathoms, till you see two large trees, close to each other, on the Barra shore, and which are but a little to the eastward of the River Fallanda; keep them a-head, borrowing still on the shore, till you bring that river to bear about E. by N. 5 miles; then you may steer in, South and S. by E., to avoid the *Middle Ground*.

When you get Fallanda River to bear as above, be sure to advance no nearer to the Middle Ground than in 6 fathoms, for the next cast of the lead may be only 4 or 3 fathoms; but, on the Barra or eastern side, there are regular soundings.

When Banyan Point bears South, and the point of the river called *Barsally* or *Satum*, near the Broken Islands, North, you are clear of the middle; but, for safety all the way, let Banyan Point be S. by W., before you bear away for the river's mouth.

Having approached within one or $1\frac{1}{2}$ mile of Barra Point, from which a small spit stretches off S. by E. a quarter of a mile, keep over for the middle between that point and Banyan Point. You have 8, 9, 10, and 14, fathoms between the two points, and good anchorage in 7 fathoms of water, muddy ground, Barra Point, bearing N. E. by N., and Banyan Point N.W. The best channel is with $5\frac{1}{2}$ and 6 fathoms, soft mud: upon the Barra side, is hard clay; and on the middle, hard gravel.

The tide of flood sets on Barra Point, and the ebb directly on the Middle; be therefore very cautious during calms on an ebb tide.

The new town, named *BATHURST*, stands on the Western shore of the Gambia, close within Banyan Point, and there is good anchoring ground before it, in 5 fathoms of water.

To go up to *James Fort*, which stands on a small island, seven leagues higher up the river, keep about two thirds over the river, towards the Banyan or western shore, until you are above the islet called Charles or Dog's Isle; thus you will avoid a reef of rocks lying westward of that islet, and which is two miles in extent; so that it is not safe to keep over towards the Barra or eastern shore. In order to avoid the shelf which extends from the Banyan shore, approach no nearer to that shore, if turning, than in 5 fathoms; nor nearer the Barra side, if you are above Charles's Isle, than in 4 fathoms; but, if near that isle, than in 7 fathoms; then tack immediately, and, if below it, into 5 fathoms. You will have 6, 7, and 8, fathoms in the channel, giving *Lemaine Point* a berth of $1\frac{1}{2}$ mile, to avoid some shoals which run off from it; then you may haul in, and anchor before *Albreda*, in 4 fathoms, half a mile from it, the ground shoaling gradually within a cable's length of the shore.

After giving *Lemaine Point* a good berth, do not haul for the Barra shore, till you are abreast of *Albreda*, for the flat continues to the eastward of that point to a considerable distance.

It flows, on full and change, off *Cape St. Mary*, at 10 hours 30 minutes, and rises $2\frac{1}{2}$ to 3 feet; between Banyan and Barra Points, at 11h. 15m., the rise being 6 feet

From Cape St. Mary (the true Cape) the coast stretches 4 leagues S.S.W. true, to the *Bald Cape*, where *St. Anne's Bank*, with the *Tongui Rocks*, extend about a league into the sea, and include three sandy islets.

Upon the coast of Cape St. Mary, the ground varies all along, but it becomes whiter to the southward: when past the cape, you find a reddish sand, which, two or three leagues

leagues more to the South, changes into a gray, then into a whitish, sandy bottom; and, about Cape Roxo, it becomes such fine sand as that which is put in the hour-glasses. These varieties of ground extend from 25 fathoms in the offing, to 5 fathoms off the shore.

The coast between the two Capes, except from Cape St. Mary, to Bald Head, is very low, with a sandy beach, and covered with trees.

In sailing between Cape St. Mary, or rather between the Bald Cape, and Cape Roxo, by keeping in 5 or 6 fathoms along shore, you will find that depth down to the entrance of *River Casamanza*, $4\frac{1}{2}$ leagues to the northward of Cape Roxo; there you have only 4 fathoms, and the ground mostly red sand. About two leagues southward from that entrance, and abreast of a cliffy point, near which you may anchor, the ground is so clammy, about a musket-shot from the shore, in two fathoms of water, that the lead is brought up with difficulty.

THE ENTRANCE of the *RIVER CASAMANZA* is situate about 18 leagues to the southward of Cape St. Mary. If a bar did not obstruct this entrance, the river might be navigated by frigates; but it can be gained only by a very narrow channel, having a depth of 2 fathoms.

The Portuguese, established on the healthy and fertile banks of this river, have ascended to the distance of 60 leagues from its mouth; they have several establishments on it, the principal of which are called Zinghicor and Makia Kaconda. They carry on an advantageous trade, especially in ivory, rough hides, aromatic seeds, and woods for dyeing, with the Feloop and other negroes, who inhabit the banks of the river.

CAPE ROXO, or RED CAPE, which derives its name from the colour of the soil of which it is formed, lies $4\frac{1}{2}$ leagues to the southward of the river *Casamanza*.* Here the coast takes an eastern direction to the entrance of the *Rio San Domingo* or *Cacheo River*. The entrance of this river is obstructed by the great shoals, called the *Cacheo Banks*, which prevent vessels of great draught from entering; but the tide is perceptible at 12 leagues from the sea.

CACHEO, on the south bank of the river, is the chief Portuguese establishment between Cape St. Mary and Cape Verga, and was, formerly, very considerable. They carry on the same kind of trade here as at Casamanza. The country is singularly fertile and well peopled.

BISSAGOS.—We have now arrived at the archipelago and shoals of Bissagos. The principal isles that form this archipelago are sixteen in number, besides a great number of islets, all surrounded by shoals, as shown on the Chart. On the *Rio Grande*, the Portuguese have many establishments, and carry on an extensive commerce. The settlements of Portugal, on the coast, do not extend beyond Cape Verga. The objects of trade consist chiefly in elephants' teeth, wax, hard soap, rough hides of every kind, dyeing and building wood, indigo, cotton, drugs, resin, and resinous gums, gold in small quantities, orchelia, &c. Of this trade the people of the *Rio Nunez* partake largely.

The Channel, or Frith, within the Bissagos Isles, leads to the Portuguese settlements of Bissao, and to the *Rio Grande*, &c. The entrance lies between Cape Roxo, or rather between the Cacheo Bank, and the N.W. end of the Bissagos shoals. The latter, as shown in the Table, page 14, lies in the parallel of $11^{\circ} 40' N.$, and the mid-channel of the entrance is in $11^{\circ} 45' N.$

The extremity, or N.W. end of the Bissagos, or shoals of *Rio Grande*, is composed of hard sand. From this extremity the bank and isles extend to the southward and south-eastward, 23 leagues, toward the eastern entrance of the *Rio Grande*; and the flat, which is from twelve to six leagues in breadth, is interspersed with banks above and under water, and islands either dry, or drowned and marshy, the detail of which is little better than unknown. Of the islands, the northernmost is WARANG, which is four leagues in length, by nearly one and a half in breadth, and which lies about $15\frac{1}{2}$ leagues S. by E. from Cape Roxo.

On the 25th of December, 1789, the sloop Endeavour, of Liverpool, struck on the N.W. end of the shoal, to the westward of Warang, in latitude $11^{\circ} 40'$. Captain S. Gamble, who was a passenger in the sloop, says, in his journal, that she got over the reef, but, not being able to find a passage through the shoals and islands, was, after

* Cape Roxo is commonly laid down in the English Charts, in latitude $12^{\circ} 17'$, and longitude $16^{\circ} 43'$; but there is an unfinished outline of the Bissagos, published at Paris, in 1822, which represents the Cape in latitude $12^{\circ} 20\frac{1}{2}'$ and longitude $16^{\circ} 46\frac{1}{2}'$; it may therefore be, and probably is, a little more to the northward.

twenty days search, obliged to return the same way she went in, and carried three fathoms of water over the bank. All the islands they saw were inhabited, but the natives did not appear to have any canoes, and the few which they persuaded to come on board, in hopes of finding a pilot among them, became sea-sick. When the vessel struck, Warang island bore E.S.E. about four leagues; and, when she was near the northernmost point of that island, the isle or kay, called Isle Cayo, on the north side of the Frith, bore N.N.E. between 4 and 5 leagues.

The north edge of the shoals of Rio Grande, adds Captain Gamble, is in latitude $11^{\circ} 40'$, and we led round them in $11^{\circ} 43'$, carrying from 11 to 15 fathoms. The tide of ebb runs very strongly over the flats to the S.W.; and, within the heavy breakers, the ebb runs W. by S., and the flood E. by N. The tide, at full and change, rises 12 feet.

The PASSAGE to BISSAO.—The entrance of this passage is described above. From that entrance vessels may sail to the S.E. by E. [*E.S.E.*] in mid-channel, 40 leagues, without meeting any shoal that is not visible; and, in soundings, generally, from 7 and 8, to 9 and 10, fathoms of water.

If bound to this place, make Cape St. Mary, at the entrance of the Gambia; and thence, run down, along shore, keeping in about 10 fathoms of water, and no nearer, till you have made the length of Cape Roxo, or the parallel of $12^{\circ} 15'$. The headland is a low sandy point, with trees on it, whence the land trends eastward towards Cacheo.

Should you fall in with Cape Roxo in the evening, come to an anchor, bringing it to bear north, as then you will be well laid, in order to proceed farther.

From the cape, as above, with an ebb-tide, steer S.S.W. 10 leagues; with a flood-tide S.W. by W., and you will reach the depth of 10 fathoms, off the *hard spit* of sand, or N.W. end of the banks. Here you will have six or seven casts of the lead, hard ground, with the same depth of water; then, all at once, coming into soft ground again, you will be over the spit. Haul up immediately, and steer S.E., which course will lead you in sight of some of the islands on the starboard hand, with the breakers bordering the north side of them. Hence take your soundings from 4 fathoms off the bank, and no deeper than 10 fathoms, on the south side. Should you shoalen your water on the bank, haul off, and you will soon deepen it again.

Proceeding thus, you will come in sight of the small, but very high, Isle Cayo, on the north side, which will make a-head of you; this islet is bold-to, and you pass on the south side of it. Thence steer E.S.E. till you gain the length of Giombe Point, on which is a thick forest.* Beware of approaching too near Giombe Point, as a reef stretches from it to some distance; and, from off it, steer S.E. until you make a small island right a-head, called Parrot Island.

Proceed onward, leaving Parrot Island to the west, until you make St. Martin's or West Point or the south point of Bissao, which has a remarkable tree on it: then run E. by N., along the S.E. side of the island, giving it a small berth, until you have Bourbon and Sorcerer's Isles a-head. You may run, if you choose, between Bourbon, which is the smallest, and the main; but, if that channel be not preferred, take the south side of Bourbon, close on board, and pass between the islands to the N.E., whence you come to an anchor off a white house, a convent, at BISSAO, in 7 or 6 fathoms, and about 4 leagues to the eastward from St. Martin's Point, in a good road and harbour.

RIO GRANDE.—If bound to the RIO GRANDE, you proceed up to St. Martin's Point, according to the preceding directions, and thence fetch the little island ARCAS, which lies at 3 leagues to the S.E., taking care not to approach too near, because a bank, partly dry, stretches from it, on the West, above 3 miles. Advance no nearer than in 4 or $4\frac{1}{2}$ fathoms, at least: now steer South, about $2\frac{1}{2}$ leagues, until you reach the narrow part of the channel, between Ilha das Gallinas, (*Hen Island*), on the starboard, and the Race Point of Boolam Island, on the larboard, side. The same course, continued for about $2\frac{1}{2}$ leagues, will lead clear of the shoal, stretching from the south side of Boolam, whence the course to the Rio Grande is N.E. by E., and E. by S., leaving the island and shoal of Mantere on the starboard side.

RIO NUNEZ.—The RIO NUNEZ, or River of NUNA TRISTAO, is a very considerable river, broad at its entrance, but impeded by several shoals, among which the least water in the channel is 3 fathoms. It has been celebrated as a place of great trade for ivory. The situation of the entrance is shown in the Table, page 14.

* See the particular Chart of the Coast from Senegal and Cape Verde to Cape St. Anne. Google The

The descendants of the Portuguese, who still exist on the banks of the Rio Nunez, are so mixed with the negroes, that they have been described as negroes themselves. The *Naloo*s of this country, a very intelligent and gentle people, are farmers and graziers; they grow a quantity of rice, and their lands are fertile and populous. They are said to have made some progress in agriculture; the indigo and cotton, which they raise, are the finest in all this part of Africa; and they manufacture pieces of cotton cloth, which, from their texture and fine colours, are much sought after by the Foulahs of Teemboq, in the country to the eastward, who purchase them at a high price.

THE COAST FROM THE RIO NUNEZ TO SIERRA LEON.—From the Rio Nunez to Sierra Leon, in an extent of about 45 leagues, the coast is, in general, low, in most parts swampy, and intersected with creeks, which, connecting the adjoining rivers, form an excellent inland navigation: but, at unequal distances, from 5 to 20 miles, in a right line from the sea, the land rises gradually; and, beyond that distance, in many places, towers into lofty mountains, which, after a tornado, when the air is pure, may be seen 10 or 12 leagues off.

At the distance of about 6 leagues to the S.E. by E. from the mouth of the Rio Nunez, is the inlet of *CAPPATCHES*, four leagues and a half to the southward of which is *CAPE VERGA*, a low point, on the westernmost point of the *Caza Islands*. The high mountains of Cape Verga, which stand about three leagues inland, to the north-eastward of the cape, serve as a mark for it, and may be seen at the distance of 15 leagues. Thus, bearing East [*E.N.E. $\frac{1}{2}$ E.*] are they equally useful to ships bound to the Rio Nunez, which, with this bearing, will clear the banks lying without the river, at 5 or more leagues to the south-westward.

RIO PONGO.—The Rio Pongo is well known as a place of trade on this part of the coast, and its consequence has been increased by settlements of slave-traders on its several branches. To the country are several entrances, or inlets, but all seem to be included under one general name, *Rio Pongo*; each is impeded by a bar of mud or sand; and the coasts, to the head of the several rivers, are entirely covered with mangroves.

The best channel in, for a stranger, is over that called *Rissing Bar*, or the *Mud Bar*, which lies in latitude $10^{\circ} 2'$, and extends more than two miles out from the river to the westward. On the north side of it are only 6 feet, on the south side from 6 to 9 feet, and on the middle 12 feet, at low water. From this bar, two hills up the country bear E.N.E., and serve as the mark for the river. A grove of palm-trees, on the north-side, is also a distinguishing mark.

If bound to this place in the night, approach no nearer than to the depth of 4 fathoms until day-light. If beating in, stand no farther to the northward, than to bring the two hills in the middle between the two points of the river: then stand to the southward to 2 and $2\frac{1}{2}$ fathoms, and proceed as shown hereafter.

If going in, with a fair wind, bring the north point of the river, with its palm-trees, to bear N.E., and run in with it bearing N.E. by E. On entering, keep on the south side, within the bar, as the flood-tide sets on the northern breakers. Should you here have a quarter-less-two, you need not fear, as the bottom is all of mud. The river hence lies E. and W., about 8 miles, and its depths, in mid-channel, are 3, 4, 7, 6, and 5, fathoms.

The *SAND BAR* is 5 miles to the southward of the *Mud Bar*, and its entrance is more intricate; therefore not to be attempted without a good pilot. This is, nevertheless, the *Mouth of the Rio Pongo*, properly so called. In the best channel, at the entrance, the depth is 12 feet at low water, and within are 4 and 5 fathoms.

The time of high water here, on the full and change, is 9 hours. The rise about 10 feet.



Sand Bar of the Rio Pongo, N.N.E. $\frac{1}{2}$ E.—A—Barkia Hill; remarkable table land.

From the *Mud Bar* of *RIO PONGO* to *DEMBIA RIVER*, a place of some trade, the bearing and distance are nearly S.S.E., 8 leagues. Two leagues to the southward of the latter is *Dania River*, whence the land juts out to the S.S.W. true, 6 or 7 miles to *Tumba Point*; beyond which, to the eastward, is the high volcanic land of *Sangaree*; and westward, are the *Ihas dos Idolhos*, or *Isles de Loss*, at $2\frac{1}{2}$ miles from the point.

To the southward of Tumba, the land recedes towards the east, forming a deep sandy bay, between it and Matacong Point; at a league and a half from which, and on the bank, is an islet of the same name. In the bottom of this bay are the rivers Guaiaport and Burria, the former of which has been a place of considerable trade.

To the southward of Matacong is *Kissey River*, which receives two others, the *Berrieria* and *Kiangasa*. Sama River lies $2\frac{1}{2}$ leagues to the southward of Kissey; and, at about 4 leagues south of Sama, are the great and little *Scarries*, two rivers of trade: from the mouth of these a sand-bank extends out to seaward, 5 miles from shore, and on this the water is shoal.

ILHAS DOS IDOLHOS, or ISLES DE LOSS.—Of these islands only three are inhabited, the rest being little better than rocks. They are extremely pleasant, and, in general, healthy. The easternmost island, on which the English factory is established, lies nearly North and South, with a high wood-crowned hill at each end, which, when seen from sea, appears like two islands. The road is on the eastern side; and, during the dry season is very safe: but, in the tornado and rainy season, there is no security unless in the goodness of anchors and cables.

Tamara, the largest and westernmost of these islands, is nearly semi-circular, rising on both sides from the sea, by a gentle ascent, to a moderate height; covered with good timber-trees, and surrounded on all sides, except to the N.E., by a rocky shore.

M. Golberry says, "The three principal isles of the group unite to the advantage of a situation very favourable for commerce, those of a fertile soil and healthy climate. They are exempt from those local diseases produced by stagnant and corrupt water, because they abound in pure and fresh springs: as the soil also rises in hummocks, above the sea, they enjoy those refreshing breezes that allay the heat of the suffocating climate at the rising and setting of the sun.

"The English establishments," he adds, "are conducted with the greatest address. The residences of the commercial agents, &c., are commodious and wholesome; and the magazines, docks, and warehouses, have all requisite solidity."

A recent description of the Idolos or Deloss Isles, has been written by the *Baron Roussin*, a captain (since Admiral) of the French navy. In this he says, the isles worthy of description are *Tamara*, the *Isle Idolos*, or *Factory Island*, and *Crawford's Island*, by the French called *Isle Françoise*. Tumba, on the east, is so connected to the continent by beds of sand, mostly dry, that it can hardly be considered as an island.

TAMARA, the largest and westernmost island, may be seen, in fair weather, at the distance of seven or eight leagues. On approaching, it appears like a range of hills, thickly wooded; its elevation is moderate, and the northern part higher than the south. It is, in shape, like a crescent, with many good anchoring-places in its southern concavity; common depth, 6 fathoms at low water. At the principal anchorage in the S.E., is a spring of fresh water, that will yield 80 hogsheads in the 24 hours. To the north of the island is a rock, marked *doubtful* in the Charts, the situation of which has not yet been correctly ascertained. It was discovered, for the first time, by the *Arctusa*, Captain Collins, which was lost there in 1811. *Le Rubis*, a French frigate, was also wrecked there in 1813.

The English establishment now occupies *Crawford's*, as well as *Idolos* or *Factory Island*. The resources for shipping at the isles, are abundant and important. Exclusive of wood and water, which may be readily obtained, supplies may be had of cattle, rice, kids, poultry, giramont, bananas, oranges, and citrons. The cattle are small; but the flesh is well flavored. These articles would be dear enough if paid for in money, but come cheap in exchange for articles of merchandize. The following are sure to be called for: linen cloth, hardware, gunpowder, iron, fire-arms, brandy, and tobacco.

The seasons have here been described as follow. To begin with January—About the 8th or 10th of this month, the *Harmattan*, or cold strong easterly winds, continue, with some strength, for about a week or ten days; after which, the land-wind and sea-breeze take place till about the middle of February, when the wind becomes continual at N.W. or N.N.W., till the last full or change of the moon in March. The tornadoes generally begin and prevail, more or less, till May or June: then the rains set in, and are almost continual all July and August: they begin to abate in September, and go off in October, giving place to the tornadoes, which continue till about Christmas. During the rainy seasons, the winds are mostly between South and West, or in the S.W. quarter; and the

tornadoes always blow with prodigious force from the E.S.E., or thereabouts, accompanied with thunder, lightning, and a deluge of rain. When a tornado has happened in the night, it is impossible to imagine the clear state of the atmosphere next morning; we have nothing like it in Europe.

The flood, at the Isles de Loss, sets to the north. The tide rises and flows, as shown in the *Tablo*, page 78. For the position, see page 14.

DESCRIPTION OF A PASSAGE FROM CAPE VERDE AND GOBREE ISLAND TO THE ISLES DE LOSS. BY CAPTAIN WM. WOODVILLE.*

“On the 21st March, 1791, the ship *Bell* was, at the commencement of the day, in 22 fathoms, fine greenish muddy sand, with the island Goeree bearing N. by W. 7 leagues. At sun-rise, yesterday, variation of the compass, by a good observation, $14^{\circ} 50'$ westerly. At 8, same morning, Cape Verde in sight, bearing E. by S. distance 6 leagues.

N.B. The rule prescribed in this route was to haul off shore when in less than 18 fathoms, and to haul in shore when in more than 25 fathoms of water.

The object was to ascertain the position of the shoals of Grande, and the nature of the soundings, with a view of shortening the passage from Cape Verde to Sierra Leon; to gain the benefit of the land-winds; to avoid the calm space between the meridian of Cape Verde and the edge of soundings, and, consequently, gain time; but, above all, to know to a certainty how far in-shore a ship might stand on the larboard tack, in the rainy season, when beating off the coast, on her middle passage, from the Isles de Loss, Sierra Leon, or the Bananas. Latitude, at noon, $12^{\circ} 31'$.

March 22.—In this day's log we are presented with great inequality of soundings, in very short distances, which appear the more remarkable, as the courses are almost parallel to the direction of the coast, and not right in shore, or right off shore.

It seems that, the bottom, hereabouts, is rather formed into deep hollows than high banks; yet it may be presumed that, as the falls into the hollows are extremely sudden, the banks may rise as suddenly, farther in shore; therefore great caution is requisite, as no one doubts the existence of the shoals of Grande; although, by this experiment, we find them not so far off shore as has been hitherto imagined.

As there are large rivers in these latitudes, so there are strong freshes, which, by the quantities of matter they carry and deposit, may have formed the banks; and also may, by continuations of the beds of the rivers, have formed the deep channels we have this day crossed. Latitude, at noon, $11^{\circ} 29'$.

March 23.—In this day's run we have more regular soundings than yesterday, which announces our being past the mouth of the river, and getting upon the extensive body of soundings that spread from the latitude 11° , in a S.E. direction, to the latitude $7^{\circ} 30'$, the W.N.W. point of the Bank of St. Anne.

On this great body of soundings, and in shore, are placed the shoals of Grande, the Isles de Loss, and the Bananas, which last lie on its south-east part, where it ends, and the mouth of Sherbro begins: the Bananas form one side, on that mouth, and the bank of St. Anne, with the Turtle Islands, the other side: the Bissagos Islands being on the north-west part of this body of soundings, near the shoals of Grande, and also upon them.

As the bottom of yesterday and to-day is composed of heights and hollows, in all directions, especially in latitude $11^{\circ} 30'$, these heights, in former ages, might have been much higher than they are now, and given occasion to their being then placed where they do not now exist, or placed at random in old Charts. Latitude, at noon, $10^{\circ} 31'$.

March 24.—We have still more regularity in the soundings of this day's run. The bottom takes more of the nature of the great body of soundings, which extend to the S.E. to the bank of St. Anne, and shew plainly that we are now drawing to the south-eastward, from the shoals of Grande and the Bissagos Islands, and entering fairly upon

* For the track, soundings, and quality of the ground, see the Chart of the Coast from Senegal and Cape Verde to Cape St. Anne. New edition, lately published by Mr. Laurie.

that fine plain of soundings which extends 50 or 60 leagues from N.W. to S.E., along the coast from Cape Verga to the Isles Bananas and St. Anne's Bank: this plain stretches off shore, from 50 leagues on its N.W. part, to 30 leagues on its S.E. part, between the Bananas and the edge of soundings, dropping every where from 35 fathoms suddenly to no ground, from lat. $7^{\circ} 30'$ to $11^{\circ} 30'$, in a S.E. and N.W. direction.

N.B. Between latitude $10^{\circ} 0'$ and latitude $8^{\circ} 30'$, all the soundings are safe and regular, from the edge, in 35 fathoms, to 9 in sight of land; every where is anchorage and good fishing. Latitude, at noon, $9^{\circ} 28'$.

March 25th.—The inequality of the depths, in this day's run, would tend more to mislead than to instruct the navigator, if he did not attend more to the quality of the bottom. But when due notice is taken of the scraps of lava that are brought up by the lead in the latitude of the Isles de Loss, there needs no better guide, night nor day. There is a line of this lava at a certain distance west from those volcanic islands, as well as from the mountains of Sierra Leon and the Isles Bananas, which takes the direction of the adjacent coast: within that line we find sand and mud: but, perhaps, this is only a covering deposited by the rivers. All the high lands on this coast, and the islands, are formed of lava.

It is remarkable that, in the latitude of the Isles de Loss, from the edge of soundings quite to those islands, there is less mud than is to be found in the latitude of Matacong, though only a few miles to the southward. Perhaps the Isles de Loss stop the course of it, and cause it to be deposited in the road. Latitude, at noon, $9^{\circ} 15'$. Saw Matacong bearing E.S.E.

In continuation of this day's remarks and observations, it is worthy of notice, that, when the writer perceived the soundings to consist of almost all mud, in the depths found between the hours of nine and eleven, *a.m.*, he knew to a certainty that he had overshot the Isles de Loss, which he ought to have seen, had they not been hidden by a thick fog; and, according to expectation, he made Matacong at noon, bearing E.S.E.

March 26th.—At 2 *p.m.*, being in 6 fathoms of water, the bottom consisting of thin black mud, hauled up N.N.W. with the wind at West, and, running in 6, 5, and 4, fathoms, all soft mud, made *Tomba Point*, bearing N.N.W., and stood for it, the same depth, till 8 *p.m.*, and then anchored within a small league of it.

At 6 *a.m.*, got under weigh, and stood to the westward, wind N.N.W.: Isles de Loss (say *Factory Isle*) bearing W.N.W.

At noon tacked, wind westerly, and stood into the road between *Factory Island* and *Tomba Point*; anchored opposite the *Factory*. See the Chart.—*Wm. Woodville.*

It may be useful to know that, the entrance into the road of the Isles de Loss may be by the north, or by the south, taking soundings off *Sandy Point*, north end, and rounding it in 3 or 4 fathoms, either by night or by day. When you enter by the south, it is necessary to carefully avoid the *Cooper's Rock*, especially in the night."

SIERRA LEON.—This noble river is about 2 leagues wide at its entrance, and has a safe and deep channel for vessels of any burthen. It continues nearly of the same breadth for 6 or 7 miles, and then divides into two branches, one of which contains *Tassa* and *Bance Islands*.

On the north side of *Sierra Leon* river the land is low and level; but, on the south side, it rises into hills, which, forming one upon the other, tower into lofty mountains, crowned with perpetual verdure. From the foot of these hills, points of land, projecting into the sea, form excellent bays for shipping and craft, and convenient places for hauling the seine.

Vessels bound from Goeree to Sierra Leon are recommended to gain soundings in latitude $9^{\circ} 15'$ North, on the bank which extends from the Shoals of Grande to the Shoals of St. Anne; and, having gotten bottom in 50 fathoms, gray sand, on the edge of the bank, to make a true S.E. by E. course, keeping in soundings until in latitude 8 deg. 29 min. Then make an East course good, and make the land of *Sierra Leon*, the mountains of which may be seen, in clear weather, 14 leagues off. But as, on this coast, the weather is generally hazy, even in the dry season, it is seldom seen farther off than 6, and frequently not more than 4 or 3, leagues; although, at the same time, a good ob-

servation may be had. This is occasioned by the constant vapours, caused by the sun, which ascend from the mountains, covered with thick woods.

Appearance of Cape Sierra Leon, bearing S.E. by S. distant about 5 leagues.



In standing in for soundings, and approaching Sierra Leon, keep the lead constantly going, as the current sets in various directions, but generally tending to the eastward. It is requisite to be very attentive to this particular. Should you be standing in, in the night, in latitude 8 deg. 29 min., and shoalen your water from 20 to 18, 13, and then suddenly to 8 and 7, fathoms, you will be at the distance of 3 leagues from the river, and should immediately anchor, and remain till day-light.

The danger on standing in for the cape is, the *Middle Ground*, hereafter described, which extends to a considerable distance across the river, and forms two channels: these channels have 13 or 14 fathoms at their entrance, and continue that depth (which seems to be formed by the velocity of the ebb-tide in the rainy season) 5 or 6 miles into the sea; thus occasioning the irregularity of soundings without the river.

Having made the land of Sierra Leon, bring the cape, which may be easily known by a small negro town standing upon it, to bear S.E. by S., then steer directly for it. At this place pilots for the river may be had.

The new English settlement, called *St. George's Bay Settlement*, extends from the second bay of Sierra Leon to the little River Gambia. It was ceded to Great Britain, 11th June, 1787, by King Tom, in consequence of a purchase made of that tract, by Captain *Edward Thompson*, of his Majesty's ship *Nautilus*. The new town, called *FREETOWN*, is situated on the eastern side of the fourth bay, called *St. George's Bay*.

Leopard's Island is a little islet adjacent to the extremity of the cape, on the North side, and at the entrance of the river. The opposite cape, on the South side, is that called *Cape Sierra Leon*, formerly *Cape Ledo*; the French and the Dutch name it *Cape Tagrin*. At three-quarters of a mile W. by N. from it lies a rock, called the *Carpenter*, which appears at half-tide, and on which the sea generally breaks; you leave it on the starboard side in going in: the tide sets right through, between this rock and the cape, but there is a good channel between, should you be drawn there by a calm.

In the journal of his Majesty's ship *Weazel*, Captain *George Young*, we find the following directions, &c., for Sierra Leon Cape and River:—

"In approaching the land of Sierra Leon, be careful to keep in latitude 8 deg. 28 min., and frequently try for soundings, until you make the high land above the cape. Bring the highest peak to bear S.S.E., and run in for the cape, without fear of any danger but the *Carpenter Rock*, which, at half-tide, will shew itself by the breakers over it; and, at low water, may be distinctly seen: it lies about a mile from the cape, bearing W. by N. [*W. ½ S.*] and you may go within half a mile of it.

"In the latitude above mentioned, if you strike soundings in the night, and they should be very irregular, from 20 to 12 and 8 fathoms, immediately come close to an anchor till day-light. Keep in that latitude before you make the land, in order to avoid the danger of the *Middle Ground*, a large shoal of hard sand, steep to on its western part, which bears N. ½ E. [*N. by W.*] from the cape, and not more than 2 miles from it. The only danger out of sight is this sand, which extends over the entrance of the river from the North shore. The principal channel is on the south side of this shoal; it is very bold and safe, increasing in breadth as you sail up, with regular soundings all the way to *St. George's Bay*. In turning, be careful to stand no nearer the *Middle Ground* than in 7 fathoms of water.

"After having entered the river, you will open the first bay, called *Cape Bay*, which has a very pleasant appearance; the next is *Pirate's Bay*, so called from being the place where the pirates formerly used to careen and fit their vessels; the third is called *Whiteman's Bay*; and the fourth, *St. George's Bay*, where ships generally anchor, for the convenience of getting water from the cascade. In all these bays you may catch excellent fish for the table, and sometimes take some green turtle."

The tide, at the entrance of the river, flows, generally, on the full and change, at 8h. 15m. The ebb runs eight hours, and the flood four; the rise and fall is from 6 to 10 feet.

During the rainy season, the tide is very regular and strong, running 6 and 7 knots an hour, and the ebb sets rapidly on the Middle-Ground. In the dry months, it flows on shore at 7h. 30m., with $7\frac{1}{2}$ hours ebb, and $4\frac{1}{2}$ flood. In this season, the ebb runs $2\frac{1}{2}$ miles an hour, the flood only 2.

To the foregoing observations, made by Sir *George Young*, &c., we annex the following, made by Mr. Stokes, of his Majesty's ship *Argo*, in the year 1802:—

"In entering the river, pass the cape at the distance of about half a mile, and then steer S.E. by E. $\frac{1}{2}$ E. [*E. by S.*] up the river. By sailing thus, you will avoid the Middle Ground and Carpenter Rock. The S.W. extremity of the former bears from the cape N. $\frac{1}{2}$ W. [*N.N.W.*] $2\frac{1}{2}$ miles, and forms the North side of the South channel. The Carpenter has 7 fathoms all round it, at the distance of one cable's length; the ebb-tide sets between it and the cape, S.W. by W. $2\frac{1}{2}$ miles an hour. The ground is foul between the cape and the rock, and very uneven, from 8 to 15 fathoms, and the channel does not appear safe enough for a ship to drift through it in a calm.

"Having entered the river, you will immediately open Cape Bay, which is the best place in the river for hauling the seine. To anchor off *Free-town*, the new town of Sierra Leon, bring Fort Thornton to bear S. by W.; the East point of the bay S.E. $\frac{1}{2}$ E; the West point W. by N. off shore, one-quarter of a mile, 17 fathoms, with mud. Moor with the best bower to the eastward. The watering-place here is very convenient, and the water excellent. You fill your casks in the boat, with a hose, which leads from the cascade. In sailing up mid-channel, from the cape to Faro Point, you will find regular soundings all the way, 14 to 16 and 17 fathoms. In turning, be careful to stand no nearer to the Middle Ground than 7 fathoms, and abreast the East point of Pirate's Bay than 8; as the sand in this part spits off into the channel more than a quarter of a mile, and has 7 fathoms close-to. You may make free with the shore all the way up, as it is very bold.

"The leading-mark to clear the East end of the Middle Ground is, to keep the cape shut, or just touching the East point of Cape Bay, until the whole of Tassa Island is open of Tagrin Point.

"We have now to add, that the North side of the river shoals off from Leopard's Island for more than 4 miles; and no vessel of more than 6 feet draught can approach that shore within a mile and a half, nearly as far up as Tagrin Point.

"The Middle Ground is composed of hard sand; and, in some part, large stones. It dries in two places, at about the middle of half-ebb; and, at all times, the sea breaks over it. The channel on the North side of it, running up to the middle of the river, is a mile and a half broad; and, in every part, where the writer crossed it, he found 6 and 7 fathoms. It is used by small vessels only."

Since the publication of our former edition, we have been favoured with some copious and valuable information, on the coasts and navigation of Africa, by Mr. James Finlaison. This gentleman served as master of H.M. ship *Tartar*, under the broad pendant of Sir George Collier, during the years 1818, 19, 20, and 21, and within this period he made many important observations. His directions for Sierra Leone, &c. which may be compared with those above, are as follow:

The entrance of Sierra Leon River is formed by a Cape Sierra Leon to the southward and Leopard Island to the northward. The latitude of the Cape is $8^{\circ} 30'$, longitude $13^{\circ} 12' W.$ * Variation $16^{\circ} 40' W.$

Ships from the northward, when bound to Sierra Leon, should be careful how they approach the cape. They must keep their lead going, and not approach any nearer than in six fathoms, until they see the high land of Sierra Leon. It often happens, when the weather is hazy, that strangers mistake Farran Point for Cape Sierra Leon; that point is $7\frac{1}{2}$ miles up the river, above the cape: hence they get on the Middle Ground.†

No one should stand in for the cape until he gets the high land of Sierra Leon to bear E.S.E. $\frac{1}{2}$ E. [*East*]; and, when he is six leagues off, he will observe Cape Sierra Leon

* We make the longitude only $13^{\circ} 5'$, and consider this as more correct.

† Farran Point now has a house on its summit, which serves as a good mark for the mid-channel between the Middle Ground and Carpenter, when kept well open of the north point of the Cape, and bearing by compass S.E. by $\frac{1}{2}$ E.

making in a small low point, with a ridge of cocoa-nut trees close to the water's edge; and, when within three leagues of the cape, he will observe the Carpenter Rock, having the sea constantly breaking on it. The rock and cape in one bear W. by N. and E. by S. You pass the cape within a quarter of a mile, in 9 or 10 fathoms. To sail up the river, after you have made the cape, and entered, you will open the first bay, called *Cape Bay*, which has a pleasant appearance, and is three quarters of a mile broad; the next is *Pirate's Bay*, so called from being the place where pirate's used to refit their vessels; the third is called *Whiteman's Bay*; and the fourth, *St. George's Bay*: at the latter is *Freetown*, the new town of Sierra Leon. In all these bays fish may be caught with the seine.

Having passed the cape, at the distance of a quarter of a mile, steer S.E. by E. $\frac{1}{2}$ E. [*E. by S.*] up the river; by sailing thus you will avoid the Middle Ground; the soundings will be 13 and 14 fathoms. Advance no nearer to the Middle Ground than 7 fathoms.

The Carpenter Rock lies nearly a mile from Cape Sierra Leon. It may be distinctly seen at low water, and shows itself at half-tide. The flood stream sets directly through between the cape and the rock, and there is a clear channel between: but those beating down the river, with the sea-breeze and a strong ebb-tide, must be careful, and give the Carpenter a good berth, as the ebb-tide sets strongly between the rock and the cape.

SHIPS BOUND DOWN THE COAST should be careful to avoid the shoals of St. Anne, on the outer edge of which, in latitude $8^{\circ} 0' N.$, longitude $14^{\circ} 2' W.$, are thirteen fathoms.* Four miles S.W. from that there is no bottom at 150 fathoms. This has been ascertained from having crossed them ten different times, and had always good observations.†

From CAPE SIERRA LEON to the FALSE CAPE, the bearing and distance are S. by W. $\frac{1}{2}$ W. [*South*] six miles; and from the False Cape to Cape Chilling, S.S.E. [*S.E. $\frac{1}{2}$ S.*] 22 miles. From Cape Sierra Leon to the Bananas Isles the course is South, or S. $\frac{1}{2}$ W., according to the tide. From the Cape to the Bananas there are regular soundings, from 12, 10, 8, 6, and $5\frac{1}{2}$, fathoms, four miles from the Bananas, the east point then bearing S.S.E. $\frac{1}{2}$ E., and the west point S.S.W. Here the Tartar anchored.

At Cape Chilling, the hills of Sierra Leon terminate, after having made a high double land, which is seen a great way off; the mountain near the south is of a prodigious height, its summit being perpetually covered with clouds, and can be perceived at the distance of 14 or 15 leagues. The cape itself is low, and full of trees; and, at four or five leagues off, appears like a small island.

About two leagues to the westward of Cape Chilling is a large rock, seen above water: nearly three leagues west from the latter is the *Isle Bananas*. In the channel, between that rock and the island, lies the *Wolf*, a sunken rock, which is about two leagues to the eastward of the east end of the isle.

At $8\frac{1}{2}$ leagues S. by E. from Cape Chilling, is *Point Tassa*, the whole space between being called *Yawry Bay*. The *Plantain Islands*, with the *Bengal Rocks* near their west end, lie five miles without Point Tassa, on the north side of Sherbro' Inlet. The entrance of that inlet is six leagues broad, between Tassa Point and the westernmost of the *Bashaw* or *Turtle Islands*, lying to the S.W. of it: these islands extend as far as *Cape St. Anne*, the west point of Sherbro' Island.



The Bananas appeared as above, from the Tartar's anchorage, at the distance of five miles. Between the ship and island the water deepened to 8, 9, and 7, fathoms. Within

* But see the particular Chart of the Coast of Africa, from Cape Verde to Sierra Leon. It appears, from Mr. Finlaison's remarks, that the shoals of St. Anne, are by no means so dangerous as they are commonly represented. He says that, from latitude $7^{\circ} 36' N.$ longitude $14^{\circ} W.$, steering N.E., three miles, 49 fathoms, sand and mud, were found on the edge of the shoals: thence continuing a N.E. course, the water shoalened suddenly to 13 fathoms, and less water, on sailing toward Sierra Leon, was not found.

On crossing the North end of the shoals in $8^{\circ} N.$ from longitude 14° , 13 fathoms were also found: in latitude $7^{\circ} 56'$, 8 and 9 fathoms. In latitude $8^{\circ} 14'$, long. 14° , were 49 fathoms; steering thence S.W. by S. 3 miles, no bottom at 100 fathoms.

† Directions for Sailing from the Bight of Biafra to Sierra Leon have been given in treating on the currents, page 101.

a cable's length of the shore, between the westernmost island and the next, there is a depth of only two fathoms. The westernmost islet is inhabited by only one Frenchman, *Jean Baptiste Major*, and his four slaves.

In YAWRY BAY, between Cape Chilling and Tassa Point, the shore is bordered with oyster-beds. The bank, stretching five or six miles off, is uncovered with the ebb, and has only four feet over it at high water. From the edge of this bank to the eastern edge of St. Anne's shoals, the distance is about 11 leagues, and the depths of water from 3 to 5, 6, 7, 8, and 10, fathoms. The Bananas Island, which lies in the middle, is about four miles long, from east to west, and one broad. Its islets to the S.W. are encompassed with rocks. The large island, which is all rock, has two small harbours on the easternmost point.

In coming from Sierra Leon to Bananas Island, steer directly for it, as there is no danger. The best anchorage is in five fathoms, two miles from shore, on clear clayey ground. Here the easternmost point bears S. $\frac{1}{2}$ E., and the highest hill S. by W. $\frac{1}{2}$ W. Between this and the shore are 10 and 12 fathoms of water, but the ground is very foul. There are sandy bays, which may be seen from the anchoring-place, and where you may land; but the best landing-place is at the S.E. end: wood and water are to be obtained here. When you bring three small islands to bear N.W., you will be abreast of the watering place, which is close to the beach, a very good run of water. The tide flows here, on the full and change days, at 8 h. 15 m.; the flood is from the N.W., and the ebb contrary.

The tides divide off the False Point of Sierra Leon. To the northward of that point the flood runs to the north; to the southward of the point it sets to the south.

At Bananas the tide rises 9 or 10 feet perpendicular during the equinoxes; other spring tides 8 or 9: but, at the Plantain Islands, more to the southward, it rises about a foot and a-half more than at Bananas. At the Turtle Isles the rise is 6 or 7 feet, common spring tides.

Mr. Woodville has said, "It is very evident that the whole chain of mountains called Sierra Leon, as well as the Isles Bananas and the Isles de Loss, are the productions of volcanoes; if we are to judge from the great quantity of lava found there, and from the small pieces of it taken up by the lead, in sounding, at certain distances from the land, opposite to these islands, and no where else; also from the conical figure of many of the hills, and from the ferruginous soil in the country."

SHERBRO' INLET.—The Inlet or Sound of Sherbro', commonly called Sherbro' River, is between the island of that name and the main land. The westernmost headland of the island is Cape St. Anne, $5\frac{1}{2}$ leagues to the eastward of which, on the north side of the island, is *Jenkins*, off which ships of great draught mostly lie.

DIRECTIONS FOR SHERBRO' INLET have been given as follow: From off the west end of the island Bananas steer south, towards the Bengal Rocks, so as to give them a berth of about a league: having rounded these rocks, steer S.E. by E. $\frac{1}{2}$ E. four or five leagues, taking care to avoid the hard sand-bank on the east, which is steep-to. In running on, you may shoalen your water to four fathoms, on the flat of Yallooka River, upon the eastern side, and thence steer S.E. $\frac{1}{2}$ S. if flood-tide, or S.E. upon the ebb, for *Pow Grande*, or the western part of Sherbro' Island. You may run close up to Pow Grande, that coast being bold, and thence steer E. by S. along shore for Jenkins. A small vessel, bound to Bagroo River, on the main, may steer along shore for Bob's Island, to within a league and a half of it; then N.E. by E. for the point of the river. From this, keep the larboard shore on board, as high as you please to go.

To sail to YORK ISLAND, in the River Shebar, off the easternmost part of Sherbro' Island: from the channel between Jamaica Point and Bob's Island sail to the S.E., until you open the creek on the starboard hand; then, to avoid a bank in the middle, which is, in some places, dry at low water, steer directly for the west point of the island on the larboard side, going close along the island, which is steep-to, and proceeding in that direction till the east end of it bears N.N.E. Then steer over S.S.E. for Cuckold's Point; and from thence S.E. for York Island, close to which you may lie in five fathoms of water.

THE WINDWARD COAST.

THE name of *Windward Coast* has been given, by our navigators, to the whole of that coast which extends from Cape Mount to the River Assinee, where the Gold Coast begins: it includes the three particular coasts called, 1st. *Grain Coast*, or *Malagette-Pepper Coast*; 2d. *Ivory or Teeth Coast*; 3d. the *Coast of Adou*, or *Quaquas*.

From January till May, it is fair and clear weather, with cooling breezes, and gentle westerly winds, on this coast. But, about the middle of May, the south and south-east winds begin, accompanied not only with hurricanes and stormy gusts, but also with thunder, lightning, and great rains, which continue till January.

A general direction for sailing along the Windward Coast, as given by Mr. Norris, is as follows :

A ship may run down the coast, in the night, by the lead, keeping in 18 fathoms between Cape Mount and the Rio Sestros, or River Sesters ; thence, as far as Settra Krou, in 20 fathoms ; and thence, towards Cape Palmas, in 22 fathoms : but, when near that cape, in 24 or 25 fathoms of water.

From soundings of 50 fathoms, the opposite land is seen off deck, at about 6 or 7 leagues distant.

From the River Shebar, at the easternmost end of Sherbro' Island, to the River Gallinas, the distance is about six leagues. The river is navigable for boats only, and its entrance often becomes dangerous, by the breaking of the sea. About five leagues thence is the *River Manna*, formerly called River Nun, at the mouth of which you can anchor, in nine or eight fathoms. This mouth is shut up by the beach, on which there is always a great surf. Three leagues farther, you find the Little River Sugary, beyond which is the bight formed by Cape Mount, having from 10 to 14 fathoms of water, black mud.

Mr. Finlaison says, From the River Gallinas to Cape Mount the coast is very low, and covered with trees. It has a fine sandy beach all the way. About five or six miles off there are regular soundings, from 11 to 12 fathoms, mud and sand, until you arrive at Cape Mount. The Tartar anchored in 15 fathoms, muddy bottom, Cape Mount bearing S. by E., and a remarkable large clump of trees North. Merchantmen anchor farther in, at 9 and 10 fathoms.

The Grain Coast extends from Cape Mount to Cape Palmas.

CAPE MOUNT, which may be seen at the distance of eight or nine leagues, is composed of high hills, projecting into the sea : on each side the land is low, rather higher on the north side, with a flat sandy beach on the east side ; the cape itself being remarkable by its cliffs.

To fall in with Cape Mount, (which, in coming from the westward, appears as beneath, when two leagues off,) you ought to keep in the latitude of 6 deg. 40 min., having, on account of the current, which sets towards the shore, frequent recourse to the lead, when you think yourself near the land. In the night you may not approach it nearer than to 26 fathoms, unless well acquainted.



Cape Mount, E. by N.

To the westward of the cape lies the road, into which you may run, until the point of the cape bears South, and S. by E. There, in the summer-season, that is, between October and May, when the weather is generally fair, is anchorage in 9, 8, 7, and 6, fathoms, sandy ground ; but it is more common to lie in 15, 14, 13, 12, and 10, fathoms, because the tornadoes and southerly winds sometimes make a very hollow sea.

In coming ashore with your boat, you must bring a hawser with you, and fasten one end of it to the land, the other being dropt with an anchor to seaward, so that you may prevent the breakers by it ; for you run directly against the flat beach below the town, without any shelter of banks or cliffs ; in the morning, you may easily get ashore with smooth water.

From Cape Mount to Cape Mesurado or Monte Serrado, in an extent of 14 leagues, the coast is very low, with a sandy beach, and covered with trees of different colours. Off the River St. Paul, ships may lie near the shore, at pleasure, in from 16 to 6 fathoms, good ground.

It must be observed here, that, from Cape Mount to Cape Mesurado, as well as upon the coast from Cape St. Anne to Cape Mount, the rains begin with May, and continue till October, accompanied with great thunder and lightning, and furious gusts of wind from the north-west quarter; during that time the sea sets so hard to the N.E. along the coast, and with such mountainous billows, that it is impossible to approach the shore; so that ships, which, between July and September, happen to fall below Cape Mount, cannot, without great difficulty, get about to the South.

Cape Mesurado is a high mountain, almost perpendicular on the North side, and sloping into the sea towards the South. There are regular soundings, 15 to 20 fathoms, muddy bottom, at 8 miles off shore, along which the current sets strongly. *Cape Mesurado* appears like an island at 7 leagues off, the land on each side being very low. At 2 or 3 miles off shore, with the cape S.E. by S., is a depth of 15 fathoms, muddy bottom, and a common anchorage.

To anchor at this cape, in the rainy season, bring the Mount to bear S.E., distance off shore 3 or 3½ miles, and come-to in 14 fathoms of water. Here a ship may be well supplied with rice; and all sorts of timber for barricadoes and bulk-head stanchions.

The COLONIZATION SOCIETY of the United States of North-America have attempted the establishment of a colony at Cape Mesurado, which is attended with all the best wishes of the friends of humanity. Of this establishment very favourable accounts have been received; and it was stated, in 1822, that the people were contented and happy, the country healthy and fertile, the natives friendly, and the concern altogether prosperous.

[*The COAST of GUINEA, with its islands, &c., including all the extent from CAPE MESURADO to the CAPE of GOOD HOPE, is copiously described in our Memoir and Instructions for the Ethiopic or Southern Atlantic Ocean, pages 72 to 128.*]

- 3.—THE AZORES, OR WESTERN ISLANDS.

The AZORES, or WESTERN ISLANDS, are nine in number, and named Santa Maria, or St. Mary's, St. Miguel, or St. Michael's, Terceira, or Tercera, St. Jorge, or St. George's, Graciosa, Fayal, Pico, Flores, and Corvo. The land is, in general, high, the coasts steep and rocky.

These islands are said to have been discovered, about the middle of the fifteenth century, by Joshua Vanderberg, of Bruges, in Flanders, who, in a voyage to Lisbon, was driven to them by stress of weather. At Lisbon he boasted of his discovery; on which the Portuguese, in that spirit of enterprize so strongly manifested by them at this period, set sail and took possession of them, calling them *Azores*, or *Isles of Hawks*, from the many hawks and falcons found amongst them. It appears that they were entirely destitute of inhabitants, and of every animal excepting birds. The latter were numerous, and of various species.

Antonio Gonzalo says, that the great Don Henry, Prince of Portugal, considered these isles as so considerable an acquisition, that he went in person to take possession, in 1449. This was about forty-seven years before Colombo landed in America. And, it has been affirmed that, the Flemish merchants, on the part of their countrymen, sent a colony thither, many of whose descendants continue in Fayal to this day. Hence the isles have been also called *Flamingos*, or *Flemish Islands*.

The capital of the Azores is *Angra*, in Terceira, the residence of the civil governor; but the general residence of the bishop is in the island of St. Michael.

Exclusive of a subsequent and temporary possession of the islands by the Spaniards, there are few interesting events in the history of the Azores. The illustrious POMBAL is said to have been the first Portuguese minister whose wisdom extended to these islands. He improved them by his authority, and adorned them by his munificence; yet a bigotted ministry, which succeeded him, a cabinet formed by ignorant churchmen, involved the islands once more in that gloom which appeared to be dispersing, covered them with nests of ecclesiastical hornets, and re-established a system of oppression, under which they have since groaned. In brief, these islands, though peculiarly favoured by Providence in other respects, are under the dominion of a sordid and luxurious priesthood, and subject to the control of a licentious military power.

The inhabitants, generally, are an innocent, good, and honest, people, who prefer the olive to the laurel, and who would seek for distinction rather by industry than by arms. The climate is delightful ; the air generally clear and serene ; the soil so prolific, that both European and tropical plants arrive at the greatest perfection : the face of the earth is, however, so diversified, as in some places to exhibit, within a small extent, volcanic hills and productions, gardens of aromatic plants, pastures, vineyards, orangeries, &c. The greatest inconvenience of these isles is, their having been subject to eruptions and earthquakes ; and, in some parts, where the coasts are low, the sea has, at times, overflowed the land, and occasioned considerable mischief. Yet, in the cultivated parts, the lava, once a stream of fire, is planted with oranges, lemons, and vines ; and the land, formed from the decomposition of volcanic substances, is sown with Indian corn, small beans, and wheat. The islands still abound in waste lands, fit for the cultivation of hemp, the vine, &c.

Being generally mountainous, they may be descried from a considerable distance ; particularly the peak on the Isle of Pico, noticed hereafter, which may be seen more than 20 leagues off.

In the winter season, storms, with much wind and sea, dark and rainy weather, from North to West and South, are frequent.

ST. MICHAEL'S.—The Island of St. Michael appears to have been originally a plain, covered with beautiful trees, rich verdure, and aromatic plants ; at the present time, however, it consists of a number of mountains, hills, and declivities, none of which are primitive, but evidently the production of volcanic eruptions. The mountains and hills clearly indicate, by their conical figure and the cavity at their summits, their being the production of fire, and bear unequivocal marks of the effects of this destructive agent, in an accumulation of lava, scorïæ, and volcanic sand.

Externally, the volcanoes appear extinguished, but they are supposed still to burn internally and invisibly. Of this, *Caldeiras*, or fountains of boiling water, in the Valley of Furnas and other parts, are evident symptoms. Circumstances, also, afford strong reasons for believing that there have existed three principal craters, whose vertex now form three great lakes, situate towards the centre and the northern and southern portions of the islands. From those craters vast mountains have been thrown up ; and, in proportion as these ceased to vomit forth matter, partial eruptions burst out, and formed the lateral hills and declivities, which extend themselves in every direction from the mountains surrounding the lakes. The cessation of fire from the different craters has been attributed to water, which appears to have gained access to each, and suddenly extinguished the effervescence of its mineral contents : and the fire now seems confined to stations, where it operates only in boiling the water, with various degrees of activity and force.

Exclusive of the remains of burning volcanoes, the island presents decisive evidence of its having been the theatre of repeated earthquakes and convulsive shocks. In most countries, earthquakes are produced by sulphur and nitre, or by sulphur sublimed from pyrites, and ignited, in subterraneous caverns, by a fermentation of vapours, which gives an appulse to the neighbouring combustible matter, and causes it to be discharged with a noise like thunder, and sometimes with an eruption of water and wind : but here the earthquakes seem to have been occasioned by a contrary cause ; by the bursting in of the waters upon the mineral fires ; an agency which must have instantly produced sudden blasts, violent explosions, rumbling in the bowels of the earth, and that lifting up of the ground above it, which occasions havoc and devastation till it gets vent or discharge. That this is the case, appears incontrovertible ; for many of the existing extinguished volcanoes, which served as so many spiracles for the discharge of subterraneous fire, are rent and torn asunder by the violent effervescence caused by the sudden conjunction of the two opposing elements.

The effect produced by this unnatural confluence of fire and water, is not confined to fissures in the craters, and rents in the cliffs ; some mountains have been precipitated into the adjacent valleys, others upset from their base, and some swallowed up in the bosom of that earth, whence they originally rose in lava, scorïæ, and sand. The bases of the precipitated mountains, exhibit palpable remains of decomposed substances originally produced on the surface of the globe ; the strata of the mountains nearly upset, is displayed perpendicularly, and not horizontally ; and those mountains which have been swallowed up, have left behind them some frightful chasms, tremendous precipices,

or form the beds of beautiful lakes. The more perfect mountains are of a conical or hemispherical figure, as formed by continued eruptions, and their exterior is distinguished by characters which denote the nature, and, in some measure, the date, of the conflagration. The lava, on some, appears in craggy eminences; and, on others, is in a state of decomposition, forming a soil highly fertile and productive. The various features of the ground show where the lava ran without interruption, only filling up inequalities in a lovely champaign country; and where its course was impeded so as to leave insulated spots or oases, covered with all the bloom of luxuriant vegetation, while encompassed by mountainous ridges of volcanic ashes, with ferruginous and pumice stone.

The island, at length, seems to be of such a structure and conformation, that the waters pass freely throughout its volcanic caverns, and are easily forced out without shaking or disturbing the earth. One hundred years have elapsed since the inhabitants have been terrified by volcanic explosions of a terrific nature;* and what is now heard, and that perpetually in several places, resembles the flowing and ebullition of waters, with a dull noise, like that of a heavy carriage rolling along in rapid motion: and, it seems that, in consequence of the introduction of the waters into the subterraneous caverns, and of the washing away of the sulphur and nitre from their arches, the fire has ceased to appear in frequent eruptions as formerly, yet it operates invisibly on the waters contained in the caverns beneath.

These observations, which were previously written, have been corroborated by a recent event. In the early part of the year 1811, a most awful and tremendous explosion of smoke and flames having issued from the sea, at the distance of half a league from the shore, at the western end of the island. From the depth of about 40 fathoms, in the ocean, issued smoke, fire, cinders, ashes, and stones of an immense size. Innumerable quantities of fish, some nearly roasted, and others as if broiled, floated on the surface of the sea towards the shore. Thus a dangerous shoal gradually formed.† On the 10th of June, the crew of the *Sabrina*, British sloop of war, observed two columns of white smoke arising from the sea, which they supposed to arise from an engagement, and made sail towards it, but were disappointed by the wind's dying away. The smoke continued to ascend, with volumes of flame, and they then concluded it was a volcano. Next day they were close in with the land of St. Michael's, and found the volcano still raging. They learned, on the island, that smoke was first observed on the 13th of June; two or three days previous to which, there had been felt repeated shocks of earthquake in the capital of St. Michael, which threw down several cottages and portions of the cliff, towards the N.W., so that destruction was feared on the island; but these ceased so soon as the volcano broke out. On the 18th the *Sabrina* went so near to the volcano as she could with safety, and found it still raging with unabated violence, throwing up, from under the water, large stones, cinders, ashes, &c., accompanied with several severe concussions. About noon, on the same day, they observed the mouth of the crater just showing itself above the surface of the sea, where there were formerly 40 fathoms of water. At three p.m., same day, it was about 30 feet above the surface of the water, and about a furlong in length. On the 19th, they were within 5 or 6 miles of the volcano, and found it about 50 feet in height, and two-thirds of a mile in length; still raging as

* The approximation to an eruption has, however, at times appeared to have been very close. On the 11th of August, 1810, at the hour of 10 p.m., slight shocks of an earthquake were felt, which continued, at intervals of a few minutes, for four hours. Between two and three o'clock next morning, a dreadful rocking was experienced throughout the whole island; several houses, unable to resist its violence, were thrown down, and many others were greatly damaged; and such persons as sought safety in the open air were dashed to the ground. On the eastern side of the island an orifice was discovered, resembling the crater of a volcano, and out of which flames occasionally burst forth; but they do not appear to have been accompanied by any ejection of volcanic matter.

The original account of this convulsion stated, that the village of Cozas was swallowed up, and that a lake of water remained in its place: but we have been informed, on the most respectable authority, that "no such village as Cozas ever existed in St. Michael's. The shocks felt in 1810 and 1811 did considerable mischief at the Mosteiros and parish of Ginetes, at the west end of St. Michael's, throwing down many houses, church-steeple, &c.; but no lives were lost." (*St. Michael's*, 7th Oct. 1818.)

† The flames were first seen in the night of the 1st of February, but invisible indications of its operation had been felt in shocks on the island from the middle of the preceding year. Its observed situation was S.W. of Point Ferraria, and due West from the Pico de Ginetes, at about 1½ mile from the nearest shore. The ship *Swift*, with all her crew, were lost on this spot, before the existence of the shoal was known.

before, and throwing up large quantities of stones, some of which fell a mile distant from the volcano. The smoke drew up several water-spouts, which, spreading in the air, fell in heavy rain, accompanied with vast quantities of fine black sand, that completely covered the Sabrina's decks, at the distance of 3 or 4 miles. On the 20th, they proceeded on a cruise, leaving the volcano about 150 feet high, and still raging, as formerly, and continuing to increase in size. On the 4th of July they again visited it, and found that a complete island was formed, and perfectly quiet. The captain and several officers landed upon it, and found it very steep, and its height from 200 to 300 feet. It was with difficulty they were able to reach the top, which they at last effected, in a quarter where there was a gentle declivity; but the ground, or rather the ashes, composed of sulphureous matter, dross of iron, &c., was so very hot to their feet, that they were obliged to return. They, however, took possession of the islet, in the name of his Britannic Majesty, and left an English union-jack flying on it.

The form was nearly circular, and the circumference of the isle, at this time, about a mile. In the middle was a large basin of boiling water, whence a stream, of about six yards across, ran into the sea, on the side facing St. Michael's; and, at the distance of 50 yards from the island, the water, although 30 fathoms deep, was too hot to hold the hand in. In short, the whole isle appeared as a crater: the cliff on the outside as walls, steep within and without. The basin of boiling water being the mouth, from which the smoke, &c. issued.

On the 17th of June, Captain Tillard, of the Sabrina, accompanied by Mr. Read, the British Consul, with two other gentlemen, proceeded overland to the cliff nearest to the volcano; and which was between 300 and 400 feet above the level of the sea. The first appearance it presented was that of an immense body of smoke revolving in the water almost horizontally, in varied involutions; when suddenly would shoot up a column of the blackest cinders, ashes, and stones, in form like a spire, and rising to windward at an angle of from 10 to 20 degrees from a perpendicular line. This was rapidly succeeded by a second, third, and fourth, each having greater velocity, and overtopping the preceding one, till they had attained an altitude as much above the level of the eye on the cliff, as the sea was below it. The columns of ashes, &c., at their greatest height, formed into branches resembling magnificent pines; and, as they fell, mixing with the festoons of white feathery-smoke, at one time assumed the appearance of vast plumes of black and white ostrich-feathers; at another, that of light wavy branches of a weeping-willow. These bursts were accompanied by explosions of the most vivid lighting, with a noise like the continual firing of cannon and musquetry intermixed; and, as the cloud of smoke rolled off to leeward, it drew up the water-spouts, above mentioned, which formed a beautiful and striking addition to the scene.

Subsequently, this islet fell, by degrees, into the sea; and in the middle of October, no part was left above water: but a dangerous shoal remained in the place which it had occupied. In February, 1812, smoke was discovered still issuing out of the sea near the spot.*

ST. MICHAEL'S contains one city, five principal towns, fifty-four parishes, and about 80,000 inhabitants. The coast is very bold, and may be approached without fear in almost every part, the N.W. side excepted. Its military strength consists of 200 troops, in a deplorable state, with a militia of 6000 peasantry, whose arms are the pikes with which they drive their cattle. The principal fortification is the castle of St. Bras, which is close to the sea, at the western end of the city of Ponta del Gada. It is mounted with 24 pieces of cannon, but few of which are capable of service. A league to the eastward are two small three-gun forts, inefficient from decay and neglect. The island, notwithstanding, has many strong local holds; and several of the hills and passes, if judiciously fortified, would be impregnable.

* About 15 leagues to the westward, a volcano, which had appeared in 1638, broke out from the sea in 1749, and disappeared in 1723. A depth of 80 fathoms was afterwards found on the spot which it had occupied.

A beautiful print of the recent eruption has been published by Messrs. Boydell and Co. An earthquake may probably obliterate every indication of this phenomenon.

In Dr. Webster's recent account of St. Michael's, are some further particulars relative to the earthquakes, &c., in 1811, and it appears that the first appearance of a sub-marine volcano was, and left a shoal, to the westward of the spot in which the islet afterward appeared.

The rich level country is properly adapted for wheat, Indian corn, and beans, or callivances. In the lava districts are cultivated the vine and orange, which yield most abundantly. It is generally understood, that the lava, in the S.E. region of the island, is softer, and becomes fertile sooner, than that of the N.W., which retains such a degree of hardness as to be, in many parts, altogether incapable of yielding to human industry. In the intermediate parts, between the volcanic lands and the level country, the surface exhibits volcanic sand, metallic slag, pumice-stone, &c.

The inhabitants of this and the other islands were formerly compelled, by law, to confine their trade to the port of Lisbon; but latterly they have been allowed a wider range, and maintain a considerable commerce, not only with Lisbon, but with England, Russia, America, &c. From England they are entirely supplied with woollens, hardware, earthen-ware, and various other necessities, sending in exchange about seventy vessels annually with fruit. To Portugal are sent corn, pulse, poultry, cattle, and vegetables, which are paid for in returns of tobacco, sugar, coffee, trinkets, dispensations, indulgences, images of saints, reliques, &c. From America, they receive boards, staves, lumber, rice, fish, pitch, tar, iron, in pots and bars, and a variety of Indian goods, which are paid for, in exchange, by wines. The intercourse with Russia is similar to that with America, but on a more contracted scale. There exists, also, a ready-money trade with vessels which make the island for refreshment, the crews of which are furnished with cattle and provisions equal to the English and to any in the world beside; and, also, with wine, pleasant, and peculiarly suited to the health of seamen.

The CITY OF PONTA DEL GADA is the chief seat of commerce. This town appears exceedingly pleasant from the offing, and derives an air of dignity from its numerous convents, &c. There is a mole for the protection of small vessels, but those of greater burthen are compelled to ride in an open roadstead.* By deepening and enlarging the harbour, it might be rendered capable of receiving vessels of a considerable draught; and, by excavating the square of St. Francis, and cutting a canal between it and the mole, a large number of vessels might be accommodated. As it is, vessels of burthen cannot safely use it; for they would risk the danger of slipping their cables, while loading or unloading, and, perhaps, not be able to recover their station for several weeks; or, at least, not dare to attempt its recovery during the prevalence of strong southerly gales.

The roadstead and harbour of Ponta del Gada are, however, the best that the island affords. The place of next consequence is that called RIBEIRA GRANDE, on the north side of the island; but here is no anchorage; and, having no harbour, it is dependent for its commercial supplies to the towns on the south side. VILLA FRANCA, which is on the latter, has a very inferior anchorage, and that for small vessels only.

The disadvantages arising from the want of naval conveniences are greatly aggravated by the customs of the country and its government; but, with all these disadvantages, the country has improved, and exports annually about 15,000 tons of fruit, wine, and provisions, the amount of its surplus produce. Yet it has been stated to us, by a person well

* See the particular plan of this roadstead on the Chart. The following notice was issued from the office of the British Consul-General, dated St. Michael's, 10th November, 1816.

"NOTICE is hereby given to navigators, that the following LIGHTHOUSES are now establishing on the South side of this island, viz. on the top of the cathedral-steeple of Ponta del Gada city, at an elevation of 110 feet above the surface of the water, a lighthouse is completed, and lighted-up with eight glass-lamps and reflectors; at the east point of the bay, called Ponta de Galera, another lighthouse is begun, which bears S.E. by E. from the cathedral-lights, distant about nine nautic miles, will be completed about the 10th of December; and a third lighthouse, on a peak, situated at the S.W. quarter of the island, near Ponta de Ferreira, is expected to be ready by the 1st of January, 1817; and, in the event of the funds collected being sufficient, it is in contemplation to erect a fourth light at the N.E. point of the island.

"The following rates are established for the maintenance thereof: vessels under 50 tons burthen, half a dollar, or 500 reis; from 50 to 100 tons, one dollar, or 1000 reis; from 100 tons, upwards, one dollar and a half, or 1500 reis.

"The said lights will be shown every night, throughout the year, from half an hour after sun-set to half an hour before sun-rise. (Signed) WM. HARDING READ, Consul-general."

October, 1818.—"There is now a very poor light on the cathedral-tower, and another in a light-house on Ponta de Galera. They are miserable: neither of them can be seen more than six or seven miles off."

AND, LIVINGSTON.
acquainted ogly

acquainted with the island, "that arts, agriculture, and commerce, are not carried to more than a twentieth part of the extent to which they might extend; nor is the population by any means proportioned to the extent of territory."

The COASTS of ST. MICHAEL, being bold all round, may be approached without fear, as there are no rocks or dangers more than a furlong from the shore, excepting some rocks at the N.W. end, and the volcanic shoal, already described. The former extend about half a mile from the bay of Mosteiros, near the north-western point. The winds most prevalent, from October to April, are from S.W. to N.W., which frequently come in heavy squalls, particularly from the northward. In approaching from the eastward, Ponta da Galera, the southernmost point, should have a good offing, as the high land above it often occasions a calm, and there are some rocks off the point.

On approaching the N.W. end of the island, from the westward, the appearance is very unpromising, as it presents barren mountains of stupendous bulk, with a coast like many ramified pillars of basalt, exhibiting, at top, a few trees of stunted growth. The impression made by a scene of rough and craggy cliffs is, however, soon dissipated by a pleasing contrast on the southern coast, as this presents a beautiful acclivity, adorned by luxuriant vegetation. Open pastures, bounded by woods, vineyards, and corn-fields, interspersed with orange and lemon trees, every where meet the eye, and afford a landscape, extensive and various, that will always, in clear weather, be seen with delight.*

The ROAD of PONTA DEL GADA, of which a particular plan is given on the Chart, has good holding-ground, on which ships may ride safely, excepting during gales from W.N.W. to S.S.E. The best marks are those shewn on the Chart. Should a vessel be forced to quit the anchorage in winter, by a southerly gale, it will be best to round the western end of the island, and await a shift of wind from the N.W., which commonly succeeds a S.W. wind. Thus may the roadstead be easily regained; but, by running to the south-eastward, it may be ten days, or more, before you can beat back to the road. In beating up, keep close in shore, only avoiding some rocks which lie near Ponta da Galera. The tide sets here, as shown in the Table, page 78. Fresh water is easily procured in the craft of the island.

Those coming in, on the northern side of the island, must be cautious of not getting embayed near Ribeira Grande, as there is no good anchorage on that side in case of a shift of wind.

The ROAD of VILLA FRANCA is sheltered by the *Porto do Ilheo*, a remarkable volcanic rock, having a circular basin in its centre, with an entrance to it on the N.E., fronting the town of Villa Franca. The entrance of this basin has 7 feet of water, and is just broad enough to admit a small vessel. The basin is about 100 fathoms in breadth, and has a depth of from 8 to 18 feet; the bottom of sand and small stones. This place is resorted to by small vessels for the purpose of careening, &c. It affords shelter from gales between West and South; but, as a part of the S.E. side is low, the wind, from that direction, throws a heavy swell into it, and renders it dangerous: and vessels, caught with this wind, must be scuttled, as the only way to save them. Not more than four vessels can lie with safety on the outside, in winter, under shelter of the rock on the N.E., where there are 4 and 5 fathoms of water. The ground, near the town, is foul and dangerous; but, it is stated that, a ship may lie in 8 or 9 fathoms, between the town and islet, by fastening a hawser on shore.

The *Porto do Ilheo* is a great natural curiosity; it having been originally a volcano of great height, whose apex has fallen into the caverns beneath, and form the basin. Its appearance is extremely rugged and irregular. On its south side is a remarkable detached rock, distinguished by the name of the *Pyramid*.

The breakers seen to the N.E. of St. Michael's will be found described in the next section.

Don Vincente Tofino, in his description of St. Michael's, states that, POINT FERREIRA, the westernmost point of the island, is high and sloped, but a low point projects

* The finely cultivated lands, which will be seen in the vicinage of Ponta del Gada, once exhibited a rugged superficies of lava, and still consist, internally, of alternate layers of lava and vegetable earth. The lava, on the surface, resembles slate-coloured rock; in some places as hard as marble, in others of the consistence of indurated sand. All the principal improvements here have been made upon these obdurate substances.

from it into the sea, so as to form a rocky ridge to the S.W. At the distance of a league from land, this ridge has over it from 7 to 10 fathoms of water, and a heavy sea rises over it, very high.* The little harbour of *Mosteiros*, to the N.E., serves for boats only. Of the islets here, the largest is high, sloped, and smooth, at its summit, with an aperture through which the sea passes from one side to the other.

NORTH SIDE OF THE ISLAND.—Between the *Ponta (Point)* dos *Mosteiros* and *Ponta da Bretanha*, the land of the coast is high and rocky, and it forms the bay of *João Bom*; at the bottom of which appears a very sharp-pointed mountain, called the *Pico de Maffa*, which serves as a very useful mark for ascertaining the coast.

Within the *Ponta da Bretanha*, and extending eastward, is the long village of *Bretanha*. The country here is highly cultivated, and pasture land.

The *Villa da Ribeira Grande*, already noticed, is rich, stored with all kinds of provisions, and abounds with good water; but landing is practicable only when the sea is very smooth.

The N.E. POINT of the island is *Ponta da Reveira*: at more than three miles to the S. by W. [S. by E.] from this is the *Ponta del Arnel*, having a small port of the same name, but it is unsheltered, and the bottom rocky. The two points are of equal height, but between them is a slender bay, with sloped rocky land, in the middle of which is a very remarkable glen, wherein is a small river.

Of *VILLA FRANCA*, *Tofino* says, "It is situated on a beach, which forms but a very small bight. The channel between the islet (*Ilheo*) and coast, is of the width of three cables' length, or thereabout, and is its principal anchorage: it has 10 and 11 fathoms of water, sandy bottom, and vessels moor north and south, with a bawser on shore, on the islet; but the latter, owing to its diminutive size, does not shelter a vessel from the wind and sea between E.S.E. by South, to S.S.W. The town is capacious, and water, with all kinds of provisions, may be had here.

ISLE OF ST. MARY.—The preceding description of the appearances of St. Michael, will apply generally to St. Mary's, and the other islands. The town is on the south side, towards the west, on a bay, in which there is an islet; and between this island and the land is the anchorage, with a depth of 6 and 5 fathoms. For the position of the town and chief points of the isle, see the Table, page 20.†

ST. MARY'S has a town and three villages, with about 4500 inhabitants. Its chief productions are wheat and barley of the best quality, with wine and cattle, but only sufficient for its own consumption. It has water in abundance, but of wood little, and a scanty proportion of fruit and vegetables.

The eastern side of this island is high and broken, and the western low and even: on the first are several mountains and peaks, of which the most elevated is called the *Pico Alto* (High Peak). The coasts are clear and very bold, and may be approached with safety.

PONTA DE CASTELO, the S.E. point, is high, and has a break, which forms a peak, in the shape of a sentry-box. A vessel may anchor with this point S.W. by S. [S. by W.] and close to it in 10 fathoms, bottom of sand.

On the **EASTERN COAST**, at $2\frac{1}{2}$ miles N.N.E. [N. 20° W.] from Pta. de Castelo, is the *Ponta dos Cedros*, which is likewise high: between these is a small point, off which is a low rock, at 3 or 4 cables' length from the coast, called *Baja da Malla*, but between it and the coast is a clear passage of 12 fathoms, in mid-channel, at half flood.

At N. by W. [N.W. by N.] $4\frac{1}{2}$ miles from Pta. dos Cedros, is *Ponta dos Matos*: between is the *Pta. de la Feiteira*, with the islet and port of *San Lorenzo*. The point is high and remarkable, when near the coast: the islet is likewise high, and, on the eastern side of it, has a cave, into which the sea enters, and where a boat may be sheltered.

* There is a similar ridge, with islets on it, extending about a league from Point Matogos, the N.W. point of the island: it has from 2 to 6 and 7 fathoms over it.

† Immense quantities of molluscæ, or sea-worms, are certain signs of the proximity of St. Mary's. Some of them are of a white colour, or of arrow-root mixed with hot water, and are about 18 inches long, with orange spots on them, like the eyes of a peacock's tail.—A. Livingston.

The port of SAN LORENZO is formed by the islet and Ponta dos Matos, which are a full mile distant from each other. The bottom is sandy, and between the points is a depth of 10 fathoms, increasing gradually outward, but the depth of anchorage, should not be less than 20 fathoms. Water may be readily obtained here, by making hollows, or small pits, in the sand on the beach, where the least excavation produces water of the best quality. There are several houses and a church close to the beach.

The PONTA DAS LAGOINAS is the N.E. point of the island. The islet Lagonias, which lies off this point, is high, and sloped like a mitre; and, on being seen, in an east or west direction, exhibits a small level point, extending a little way into the sea. A rock, lying between the islet and land, obstructs the passage to large vessels.

The NORTH SIDE of the island affords neither shelter nor anchorage; the whole of the western side is low and uniform.

The PORT and TOWN are situated, as already noticed, on the S.W. side of the island. The bottom here is sandy, and in some parts rocky, with from 10 to 4 fathoms of water. The rocky part is on the western side, and the eastern is the clearest. The Ponta da Marban is the easternmost point of the bay, and this, with the next point to the eastward, *Malbusca*, form a larger bay, divided into two parts by a black point, *Pedreira*: The coast hither, from Point Marban, is the most regular, and is called *Figueral*; on the top of it is a remarkable rugged mountain, but it is not so high as those on the north side of the island. Ponte de Malbusca is high, and stands at the distance of two miles to the westward of Ponta de Castelo, the S.E. point of the island.

The ROAD OF ST. MARY is open, and exposed to southern gales. On this account it is resorted to, in summer, by small vessels only. In order to be ready for a start, it is proper to anchor to the S.E. of Marban Point, opposite Figueral, already described. The best anchorage, known to the pilots, is about a mile from the coast, in a line with Malbusca Point, and with the castle at the S.W. part of the town of St. Mary, entirely open of Marban Point. Here is a depth of 36 fathoms, bottom of sand; but, at a short distance eastward, the ground is foul. Hence it is, that Port San Lorenzo, on the N.E. side, is considered as the best anchorage about the island. At either place refreshments may be obtained, as at the other islands, with the addition of partridges, which abound here.

In the Road of St. Mary's the convoy from St. Helena took shelter, during a gale, in 1813. The following extract is from the journal of Captain Abr. Bristow, of the ship *Thames*, one of the fleet. It is descriptive, and may be useful.

"Nov. 23. Hard gales from the N.N.E., with harder squalls, attended with rain and a tremendous high sea. At one p.m., rounded a small islet, (*Ribeira Seca*, at the S.W. end of St. Mary's,) and hauled up by the wind to gain an anchoring berth; and, in a few minutes, brought up, in 17 fathoms of water, dark coarse sand and gravel. Here our whole fleet found shelter from a most dreadful storm. Our commodore saluted the fort, and it, after a while, returned the compliment. From our site the small islet bore N.W., 2 miles; the town, N.E. by E., 2½; nearest shore, 1½; and the easternmost land in view, E.S.E., 6 or 7 miles.

"Nov. 24. Blowing very hard in the N.E., so that our boats can have no communication with the shore. Feel comfortable to be so well secured from the fury of the storm. Middle part of the day, the gale still furious, with violent squalls, attended with rain. At half past eleven p.m., our cable was cut off by a rock, and we drove out to sea, but afterwards recovered our station. At one p.m., on the 25th, having got well in with the island to the eastward of the roads, I hove about, and fetched into a good anchoring berth in 10 fathoms, with the town distant one mile.—The anchor was afterwards recovered; but the best bower-cable was greatly injured by the foulness of the ground."

The FORMIGAS, or ANTS, which lie to the north-eastward of St. Mary's, are a range of 7 or 8 high rocks, extending N.N.E. and S.S.W. [*N. and S.*] about three-quarters of a mile, and among which there are other rocks under water. The highest, which is nearly 60 feet in height, bears, from a distance, some resemblance to the sails of a ship, and lies two-thirds of the length of the range towards the North. At the north part are many rocks under water. Close along-side is a depth of 7 fathoms. The Formigas have a dreadful appearance, the breakers commonly flying higher than a ship's mast-head. At a time when the sea ran from the westward, no soundings could be found off the eastern side, with a line of 50 fathoms, until within 30 yards of the rocks. The position may be seen in the Table, page 20.

Between the Formigas and the Island of St. Mary, no bottom was found with a line of 120 fathoms, until within one quarter of a mile from the island.*

To the S.S.E. of the Formigas there is a danger, which was shown on a Chart of the Atlantic Ocean, 1766; but afterwards omitted in other charts, from want of positive information as to its existence. This shoal was seen by P. Dollabarats, commander of the ship *la Marie de Sebourg*, in 1788, on his return from Martinique to Bayonne. On the 7th of March, at three p.m., when about to double the Formigas, at the distance of three quarters of a league, he descried a breaker to the S.E. of his ship, which appeared to extend a league true North and South. He observed, that it lies S.E. 5° S., (true,) at the distance of $1\frac{1}{2}$ league from the Formigas.

The following is an abstract of the Description by Tofino. "The FORMIGAS are some rocks, which navigators have considered as extremely dangerous, imagining a great part of the space hereabout to be strewed with sunken rocks, and therefore to be avoided; but, having examined these dangers, it is proved that the whole of them are visible, concentrated, and clear, and that vessels of any burthen may steer for them, in order to pass on the north or south side, as may be most convenient.

"The trend of these rocks, is N.N.E. $\frac{1}{2}$ E. [$N. 5^{\circ}$ E.] and S.S.W. $\frac{1}{2}$ W. [$S. 5^{\circ}$ W.] in an extent of about six cables' length. The larger islet is a heap of rocks, through which the water scarcely finds entrance. From this islet Pta. de Castelo, St. Mary's, bears S.W. $\frac{1}{2}$ W. [$S. 24\frac{1}{2}^{\circ}$ W.] and the highest peak of that island, S.W. by W. [$S. 34\frac{1}{2}^{\circ}$ W.] To the N. 5° E. true of the islet is a large round rock, hollow on the south side, which may be from 10 to 12 yards high, and is the highest of the whole. When viewed from a distance, the Formigas appear like a city, the inequalities in height having the appearance of edifices. On the south side of the large Formigas, at about a cable and a half, is a shoal, partly above water: there are from 7 to 12 fathoms near it, and in the channel, which it forms, 20 fathoms."

In this description, by Tofino, we have an instance of improperly blending one thing with another. The Formigas are properly described, but other rocks also exist, as shown in the next paragraph, at the distance from them of about 10 miles to the north-eastward. We derive our knowledge of the latter through the favour of Captain Livingston.

TULLOCH'S ROCKS.—In 1808, Captain Wm. Tulloch, of the brig *Equator*, of Portsmouth, New Hampshire, on a voyage from Madeira to St. Michael's, was alarmed by some of his crew's seeing breakers. After altering his course, he still saw breakers a-head, and as it blew too hard to be able to haul by the wind, and weather them, he determined, as his only chance, to endeavour to push through among them; accordingly, having taken in every sail, excepting the foretopsail, he went to the foretopmast-head himself, and conned his vessel safely through, by luffing up and keeping away, as he saw necessary. Captain Tulloch counted distinctly twenty-one heads of rocks, none of which appeared to have much water over them, and two of the rocks show occasionally above water, in the wash of the sea. Their extent the captain thinks did not exceed half a mile from north to south, and was still less from east to west. They bore E.N.E. by compass from the highest rock of the Formigas, then in sight, distant about ten miles, and appeared very black below water.

The breakers on Tulloch's Rocks, have been several times seen since 1808: among others, by the *Ayrshire*, bound from the Clyde to Demerary. Mr. Ferguson, the mate of that ship, gives their situation as about nine miles E.N.E., by compass, from the Formigas.

TERCEIRA.—This island is fertile, pleasant, and healthy; the lava districts here, as at St. Michael's, produce excellent vines, although not equal to those of the Canaries and Madeira. The land yields large crops of wheat and other grain, pasture for cattle, and a prodigious quantity of lemons, oranges, and all those fruits of hot and cold climates which are propagated to the greatest advantage in temperate countries. The capital, as already noticed, is ANGRA, on the south side of the island, having a harbour, defended by a fortress, in which resides the governor of the Azores. Angra is distinguished by several handsome churches, convents, &c. Besides this there is another town, *Praya*, and fifteen villages, all of which contain about 30,000 inhabitants. In the bay of Angra, and around the island, fish, of a good quality, are abundant.

* Abstracted from remarks by Captain Nathaniel Simpson. The appearance of the Formigas is shown on our Chart of the Azores, &c.

The coasts are high, and so surrounded with craggy rocks, as to render the island almost impregnable: every accessible part being defended by batteries, with heavy cannon, and a numerous garrison. The interior, is, in general, moderately high, but the western side is higher than the eastern, and is distinguished by a rugged mountain, extending nearly east and west, and of which, the western extremity, *Pico de la Serreta*, is the most elevated. This peak may be known by a great break on the eastern side, at a short distance.

The position of the city of Angra is shown in the Table, page 20.

At the town, provisions are cheap, and in plenty. The bay may be readily known by means of a remarkable forked hill, near the sea, on the west side, named *Mount Brasil*;* and by two steep little islets, called *Cabras* or *Goats' Islands*, which lie about 4 miles to the eastward of the mount. About 2 miles to the south-eastward of these islets, is another, called *Los Frayles*, with breakers near it.

In approaching from the S.W., South, or S.E., steer directly for Mount Brasil. Should the wind be adverse, when approaching the land, tack boldly without the bay, as there is a sufficient depth over it, and up to the shore.

But, beware of a calm, as the currents are very strong and variable. If you have not a leading wind, when sailing up towards the Mount, avoid too near an approach to the coast, between it and the westernmost part of the island: as it would, in a calm, be attended with the utmost danger; the coast being an iron coast, a ship driven on it would be in a most perilous situation.

The BAY of ANGRA is open to all winds from S.S.W. by the South to the East. The swell from the S.W., in particular, which sets round Mount Brasil, on the western side of the bay, is tremendous. The ground, at the entrance, is foul, and ships should always moor to the northward of Fort St. Antonio, which is on the west side of the bay.

The tides rise as shown in the Table, page 78. The flood sets in to the N.W.

Vessels may safely remain in the road in June, July, August, and September, when the winds are light, and prevail from between W. and N.W. But, on the commencement of winter, the winds from the offing rage so violently, that, upon the least appearance of bad weather, it is requisite to put off to sea; the coast affording no shelter.

PRAYA BAY, or PORT PRAYA, on the eastern side of Terceira, has been described as the largest and safest bay in the Azores. "This bay," says M. Fleurieu, "has the form of a crescent; the point towards the North has, at its extremity, a small islet to the N.E. To lie in the best place, this islet must shut in with the point, and the two towers seen on the bottom of the bay must be brought together; you will be then in 24 fathoms, sandy ground, the town bearing N.N.W. and North. You may also anchor nearer to the shore, in 20 and 16 fathoms. The boats must not attempt to land at the bottom of the bay towards the S.W. on account of a sand-bank, upon which they would ground; but they will find a good landing-place near the castle."

THE FOLLOWING IS A MORE PARTICULAR DETAIL OF THE COASTS OF TERCEIRA, abridged from Tofino.

The *Mount of Brasil*, near Angra, is moderately high, and has two small columns, or pillars, at the top, which serve as look-out places. The hill descends gently towards the north, and at its base, on that side, is the *Citadel* or *Fort of S. Juan*, the chief defence of the island, and particularly of the city of Angra, which stands to the northward and N.E. of it. From the citadel a line of wall and batteries extend to *Fort S. Antonio*, on the east side of Mount Brasil; the opposite or N.E. side of the bay is defended by *Fort S. Sebastian*.

Merchant-vessels regularly anchor in the line of the forts S. Antonio and S. Sebastian, or rather farther in, mooring with the four anchors. This is necessary, the bay being open to the sea from S.S.W. by South to East, and therefore extremely unsafe when winds from those quarters may be expected, the coast being mostly of sharp rocks. Large ships anchor to the eastward of Mount Brasil, in from 30 to 40 fathoms of water, sandy bottom, and they must be ready to get under weigh in the instant that the wind appears to be coming on from the south-eastward or south-westward.

On the western side of the castle of S. Sebastian is a little beach, slightly sheltered by a wall of the castle. It is called *Puerto de Pipas*, and is the spot wherein fishing-vessels are secured, by grounding them on the sand. It may serve as a landing-place when the sea will not allow you to land at the mole.

* See the particular plan of the Road of Angra, on the Chart.

The boats of the island come out so soon as any vessel is seen to anchor, and by them supplies may easily be obtained, even while keeping under weigh, tacking in and out, as they will bring water, wood, and all kinds of provisions.

The *Ponta de Las Contiendos* is the S.E. point of the island. It presents an eminence, having three peaks on its summit. At about half way between this and Angra are the *Cabras' Islands*, already noticed, which lie S.E. by E. [*E. by S.*] 4 miles from the summit of Mount Brasil, and two-thirds of a mile from the nearest part of the coast. Of the two islets, the eastern is the largest and highest: when seen from the east or west it appears like a wedge. Between the islets is a channel for row-boats, with from 8 to 10 fathoms of water: between them and the coast a ship may pass, as there are 9, 12, and 13, fathoms of water, with sandy bottom, and rocks near shore only.

The *Frayles*, or Friar's Island, before mentioned, is a low islet, having two pyramidal peaks. A shoal extends from the S.E. side of it, about a cable's length, over which the sea breaks. Several cliffs on the islet give it the appearance, at a distance, of several isles. A ship may pass, with all safety, in the channel between this and the *Cabras*, the depths being from 60 to 75 fathoms, gravelly bottom, and clear ground.

The Eastern Coast of Terceira is generally broken, rocky, and dangerous. The easternmost point is that named *Malmeranda*, which is high and oblique, with a large shoal near to it, which shows itself at low water. To the south-westward of this point is the town of PRAYA, defended by batteries. The bay on which this town is situate is of great depth, with good holding ground, and a fleet may anchor here sheltered from the south, by the west, round to north, but entirely exposed to the eastward: the safest anchorage therefore is, with Point *Malmeranda* in a line with the northern islet *Cameiros*, and the highest tower or steeple of the town, which is the northernmost, open to the west. Here is a depth of 25 fathoms, with sandy bottom: and, as at Angra, supplies may be obtained from the boats of the place.

REMARKS ON TERCEIRA, by Captain *Livingston*, 1822.—“At about six and a half or seven miles north of Angra, in a valley near the summit of the mountains, a great deal of steam issues from crevices of the earth, or rather clay, which clay, I am informed by a scientific gentleman here, is actually lava, decomposed by the action of sulphuric acid. Some of the clay looks, when cut by a knife, much like Castile soap: it is of various hues, and the natives of Terceira use it as paint. There are small quantities of sulphur formed around some of the apertures. The steam which rises is very hot: we cooked some eggs by laying them among the clay, at mere cracks whence steam issued. My thermometer ranged only to 152° of Farenheit's scale. I exposed it to the steam at the first aperture I reached, but the mercury rose so rapidly, that, from fear of bursting the tube, I was obliged to withdraw it in, I think, about three or four seconds. Persons visiting Angra, who have any curiosity in their composition, should see this *furnazo* or *souffriere*. The access to it is by no means very difficult, though, if you ask any of the Portuguese, they will describe it as accessible only at some periods of the year. One may ride to within less than half a mile of it. Poneys, or asses, and guides, may readily be hired.

“The CITY OF ANGRA is generally very regular, the situation beautiful, and the streets have regularly excellent flagged foot-paths. The houses are commonly of three stories. Mount Brasil, on the land-side, seems strong; and Fort St. Sebastian, on the Puerto Pipas side of the bay, is a small but strong fort. These fortifications were erected by the Spaniards when they were in possession of the island.

Some vessels, mistaking Praya for Angra, have stupidly run in there; but the Goat Islands and Mount Brasil are sufficient to show the most entire stranger the difference: I annex a sketch of the former.



The GOAT ISLANDS; as sketched at 9h. a.m. 25th January, 1822, when about two miles distant; the weather being hazy, and the tops of the mountains of Terceira covered with dense masses of clouds. Point at the ~ bearing N. by E. by compass, and that at

No vessels should go to Angra without two good chain-cables : the bottom in the bay being generally too foul for any trust in hempen cables.

"The better sort of people in Angra (natives) are very hospitable and kind, but full of ceremony. The poor people are generally very clean, and none seem in want of the necessaries of life. None of that wretchedness which we so often see in this country is visible ; but many of the older peasants have their clothes, though clean, so industriously patched, that it is next to, or altogether, impossible even to conjecture of what colour they originally were.

"The Terceira fruit (oranges) has improved much of late years ; more attention having been paid to its culture, and it is now little, if at all, inferior to the St. Michael's.

"Very good linen is made in the island, and they manufacture a coarse earthen-ware, the clay of which it is made being imported from St. Mary's. No noxious animal is known ; nor, though there are many dogs, has hydrophobia ever made its appearance. The natives rear a great many swine, most of which are remarkably broad-backed. Their backs are generally shaven, which, it is alleged, allows them to spread in fattening.

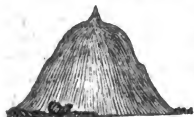
"Bloody flux is very frequent, both among strangers and natives, and is often fatal. A Scottish surgeon there told me it was the worst disease he met in the island.

"Vegetables are excellent and cheap. Poultry and eggs good and reasonable ; beef and mutton tolerable, the former about three pence per pound. Some of the island wine is tolerably good.

"I was surprised to see a pretty fair bunch of bananas one day carried by a peasant. They have apples, pears, figs, chesnuts, and walnuts, and, I have heard, some olives, with abundance of grapes. Gooseberries and currants, I am told, have been tried, but have not succeeded. They have a very fine tough willow, which makes excellent hoops and baskets ; also plenty of yams, Indian corn, wheat, and excellent barley, also tolerable potatoes. The market is generally well supplied with good and cheap fish. Rabbits and quails are plentiful : thousands of black-birds, fine turkeys, few or no geese : no peacocks and no pheasants : a few red-legged partridges ; and, I have heard it positively asserted that, there are some grouse on the mountains, yet I doubt the fact. There is a good deal of orchilla weed, which is of a grayish colour, sometimes slightly tinged with a reddish hue, and famous for producing a violet or crimson dye. It is monopolized by the government."

The NORTH COAST of TERCEIRA should not be approached by a stranger, as it is rocky and dangerous. The western coast is also inaccessible. Near the S.W. point is the Pico de Santa Barbara, a small but remarkable mountain, with a Vigia, or Look-out, on its summit.

PICO.—This island derives its name from the remarkable peak or volcanic mountain which stands upon it, and which appears, when seen over the southern coast of Fayal, nearly as represented on the margin. The summit of this mountain, whose sides are neither very steep nor uneven, is terminated by a small sugar-loaf, so very regular that one would think it had been made by art. The height of the peak above the level of the sea, according to the geometrical operations of the French astronomers, is 1100 French toises (about 1172 English fathoms) ; and, consequently, in clear weather, it can be seen 24 or 25 leagues off ; but it is frequently so obscured by clouds, as not to be seen at any distance.* When the southernmost point of Fayal is in a line with the peak, E. by S., this mountain appears as above.



* The Spanish surveyors have since given the height of the peak, from its observed altitude, above the level of the sea, as 1212½ Spanish toises (1103 English fathoms only.) The mountain, they observe, covers the whole of the western part of the island ; its skirts, and even half way up, are covered with vines ; the next fourth part by shrubs ; and the last and highest part seems all of rock, covered with a very short grass. An ascent to the summit may be made, though not without difficulty, and some caverns afford occasional shelter.

Upon the supposition that the height last mentioned is correct, when the summit of the peak appears at one degree above the horizon, its distance will be 50½ miles ; at two degrees, nearly 32 miles ; at 3½°, 19½ miles ; at 5°, more than 14 miles ; at 6½°, nearly 11 miles ; at 8°, nearly 9 miles ; and at 10°, nearly 7½ miles.

The peak has been described as filled with dark volcanic caverns, which have frequently emitted smoke, flames, and ashes, to a considerable distance. At the foot of the mountain; towards the east, is a spring of fresh water, generally cold, but sometimes so heated with the subterraneous fire as to rush forth in torrents, in a boiling state, and sending forth a stream of sulphureous vapours, vitrified stones, &c.



Pico, when the Peak (A) bears E.S.E. by compass.—B, E. by S.

Pico contains about 22,000 inhabitants, who occupy three towns and eleven villages. The soil being stony, little grain is produced, and the greater part of the wheat and maize, for consumption, is imported from the neighbouring islands. The wine is the staple commodity, and is reputed the best in the Azores. This, with brandy, is exported in considerable quantities, and is much like port, or the wine of Oporto. The cattle are various, numerous, and excellent; fruit is abundant, and equally fine. Besides these they have cedar and other timber, including a beautiful kind of yew, called *Teixo*, which is remarkably solid and fine; but which is monopolized by, and felled only by order of, the government.

The *vino tinto* of Pico, made from the Oporto vine, propagated in Pico, Captain Livingston thinks excellent; but it is not plentiful. The *teixo* wood, he says, is the same as our yew. "I saw furniture which was made of it, and saw some plants of it in a gentleman's flower-garden; it grows remarkably slow. There are some fine pine woods in the island: a good deal of box-wood and some cedar. Plenty of juniper, the berries of which are so very strong, as to leave, for a long time, a very unpleasant flavour in the mouth after chewing them.

There is plenty of pumice-stone, but of a coarse quality, in the island, and every where marks of volcanic agency are apparent. Water is good, but it is not so easily procured as might be supposed.

For the position of Pico, see the Table, page 20. The principal towns and villages are Lagens, Pico, Santa Cruz, St. Sebastian, Pesquin, S. Rocca, La Playa, and Magdalená.

The S.E. point of the island, which is rather low and sloping, is named *Ponta de la Isla*, a ridge extends from it to the eastward, one cable's length. The next projection, on the south coast, is *Pta. de Caleta*, or Nesquin, distant 5 miles, W. $\frac{3}{4}$ S. true; between are the little harbours *Muelle de Manana* and *Nesquin*, fit only for coasters, which may ground on the sand, the bottom being generally rocky. At N.W. by W. [*W. by N.*] $6\frac{1}{2}$ miles from the Pta. Caleta is the *Pta. Arrife*, which is rather more elevated, the coast between continues rocky, and is not to be approached by strangers. Eight miles N.W. by W. [*W. by N.*] from Pta. de Arrife, is that of Santa Catalina; the coast between forms a slender bay, in which, at $2\frac{1}{2}$ miles from the former, is the town and lagoon of LAGENS; the latter communicates with the sea, by means of a bar, over which the coasters pass at high water. The fishermen have another place of shelter, in *Puerto Paima*, which is on the N.E. of the point of Sta. Catalina.

On the S. W. and West sides of the island is nothing remarkable but its rocky coast and islets. From the Pta. de los Baxios, on the N.W. side, breakers extend outward, to the distance of nearly a league, during a gale.

Off the most prominent part of the western coast is the little port and isles of La Magdalená. From the town, which stands here, the greater part of the produce of the island, for exportation, is shipped off, for Fayal in small row-boats. The islets are surrounded with rocks; but very near the latter the depths are 6, 7, and 8, fathoms, rocky ground.

The north coast, from Pta. de los Baxios to the East end of the island, is altogether rugged, and may be considered as inaccessible.

FAYAL.—This island has been celebrated for its excellent pastures, fish, wood, &c. The air always mild and pure; the cold of winter never felt, and the heat of summer always tempered by refreshing winds. Its inhabitants are computed at about 17,000. The island produces wheat and maize, sufficient for itself and a part of Pico. The cattle reared here are not sufficient for the consumption of the island, and supplies are therefore sent from the neighbouring island of St. George, which produces a great number. The annual produce of wine is also scanty; for that which is exported hence is mostly from Pico, the opulent people of Fayal being owners of the best vineyards in that island, and they ship the wines from the port of Fayal for the different ports of Europe and America. A great quantity of neat baskets are made here, of the willow already noticed. (p. 194.)



Fayal, when the point (A) bears N.E. by E. $\frac{1}{2}$ E. by compass, and B, E. by S.

The chief town is the **VILLA ORTA**, on the S.E. side;* and there are, besides, nine villages on the island. The bay, on which the town is situate, represents, according to M. Adanson, a beautiful amphitheatre, clothed with trees. The town has more than 5000 inhabitants, with numerous convents. The name Fayal is understood to be derived from *Faya*, the beach-tree, with which, and other wood, the island abounds.

In the journal of Mr. Keilor, an intelligent master of the royal navy, this officer has stated that those who run for Fayal should not depend on the peak of the next island as a guide, because it is sometimes covered for five or six days successively.

Mr. Keilor adds, Fayal has a good bay, opposite to Pico, which is formed by an isthmus, extending to the S.E., and a point about a mile and a half to the north-eastward; the town has several fortifications, but in bad repair. Water, in general, is bad and scarce. A number of vessels, of all nations, here load with wines, dye-woods, fruits, and cheese.

The following is the **DETAIL** of the **COASTS** of **FAYAL**. The S.E. point is a mount, with a hermitage on its summit, dedicated to *Our Lady of Guia*. (*N.S. de la Guia*.) The north side of this is connected, by a neck of sand, to a smaller mount, of a black colour, *Caimado*, at the foot of which the town of ORTA commences. Near the mount, on the west, is a sandy cove, *Port Pin*, where, in fine weather, some small vessels load and discharge their cargoes, but it is quite open to the S.W.

The northern point of the bay of Orta is named *Espalamaca*: its bearing and distance from that of La Guia is N.E. $\frac{1}{2}$ E. [*N.N.E. $\frac{1}{2}$ E.*] one mile and three quarters nearly. At the bottom of the bay is a beach of black sand, which commences near Point Espalamaca, and terminates at Mount Caimado. Within it is the town, facing the sea. In the latter are two very remarkable buildings, nearly alike: one of these is close to the sea-side, and was formerly called the Company's College; the other is in the most westerly part of the city, upon an eminence, and is the Carmelite Convent. These objects in a line bear nearly N.N.W. [*N. 42° W.*]

Nearly in mid-channel, between Fayal and Pico, is a rocky shoal of $3\frac{1}{2}$ fathoms; it is about 20 fathoms in extent from N.E. to S.W. [*N.N.E. to S.S.W.*] and 10 broad. The marks for it are, the Company's College and Carmelite Convent, above mentioned, in one; Point de Espalamaca N. by E. [*N. by W.*] $2\frac{1}{4}$ miles; and the hermitage of Guia N.W. $\frac{1}{2}$ N. [*N.W. by W. $\frac{3}{4}$ W.*] a mile and six tenths. See, farther, the particular Plan in the large Chart.

The regular **ANCHORAGE** of **FAYAL** is in the bay opposite to the town of Orta. It is the best anchorage in the Azores, on every account, excepting that it is open to the winds from North to N.E., and from S.E. to S.W., and these winds are frequent in winter. That from S.E. is very destructive, it blowing right in. Those who anchor, should, therefore, always be prepared for a start, on a shift of wind. The safest method is to let go the anchor in 35 or 40 fathoms, where the bottom is of sand, at about a mile

* See the particular Plan of the Channel between Fayal and Pico, on the Chart. For a farther description of these islands, see hereafter.

and a quarter from the town, which will be with the Point of *Joao Diaz*, a little open to the right of Point *Espalamaca*, and the Company's College in the town a little to the southward of the Carmelite's Convent, already described. From this spot a ship may depart with any wind.

In the summer season, and favourable weather, the general anchorage is with the two buildings in the town as above described, but nearer to the town, in 25 fathoms, sandy bottom: small vessels proceed farther in, to 40 or 15 fathoms.*

To SAIL IN for the Road, if from the *Northward*, no farther direction is requisite, as the way is perfectly clear. If, in coming in from the S.W., with a free wind, the regular passage is between the mid-channel shoal and Mount de Guia; or, if more agreeable, between the same shore and Pico, according to circumstances. With the wind from the West or N.W., take especial care to avoid the shoal, by observing the marks for it, above described.

If, on approaching the Road from the S.W., the wind should be dying away from the eastward, and you intend to tack, so as to gain the anchorage, keep over towards Pico, within the distance of a mile or a mile and a half; because, at a little farther out, the bottom is rocky, and you cannot anchor, in case of necessity: besides, by proceeding thus, you will be free from variable eddy-winds and calms, which are caused by the mountains; and the coast is sufficiently clear.

SOUTHERN COAST of FAYAL.—The Point of *Santa Catalina*, which is $3\frac{1}{2}$ miles nearly W.N.W. [*W. $\frac{1}{4}$ N.*] from Guia Point, is of low and black rocky land, and it, likewise, has a hermitage: between these points is the cove of *Feteira*, with its beach and village. Near it are several islets.

The Point *Castelo Blanco* is the S.W. point of Fayal. It appears like a little round mountain of moderate height, sloped on every side, so that, at a distance, it appears like an island. The coast hereabout is rocky, and affords no anchorage.

At the west end of Fayal are the two islets named *Capelinos*, lying in a South [*S.S.E.*] direction. Between them and the coast is a channel, which, in fine weather, admits fishing-boats.

The point of *Jorge Lorenzo* is the northern point of Fayal. Its upper part is high and sloping. From this point to the N.E. point, *Riveirina*, the coast trends S.E. [*E.S.E.*] Point *Riveirina* is high and sloped, and forms a round front, of about half a mile: at the foot of it is a low point, with three islets. S.W. by S. [*S. by W.*] from this point, at $2\frac{1}{2}$ miles, is that of *Joao Diaz*, which is low, black, and rocky, with rocks at its extremity. Between the points the coast forms a slender bay; the land is high and oblique, and it presents, near the middle, a remarkable slope of a red colour, which may be seen from the mid-channel shoal, called the Shoal of Fayal.

At nine-tenths of a mile to the southward from Point *Joao Diaz*, is that of *Espalamaca*, on the north side of Orta Bay. It is high and sloping, with a small round front, having a vigia, or look-out, on its summit. Between these points, the coast is a little indented, and has a beach, with a church, at the bottom of it. Trading vessels at Port *Magdalena*, on the opposite side, when assailed by violent winds from the southward, frequently bear up, and find good shelter here.

ST. GEORGE.—This island lies at the distance of 3 leagues from Pico, and is separated from Graciosa by a channel 8 leagues in breadth. It is a long narrow island, about 9 leagues long, and little more than one in its average breadth. On its south coast is the little town called *Villa das Velas*, or *Vellas*, with a port where small vessels may lie sheltered from all winds.

This island, when *Tofino* described it, contained more than 11,000 persons, in three towns and seven villages. He says that it produces much wine of a good quality, which it exports to Terceira and America. The island has been famous from its cattle, with which it supplied other islands, and its cheese is said to be fine. The produce of wheat and maize is equal only to the consumption of a part of the inhabitants, as the lower class substitute the root of the iname. Wood and fresh water are abundant.

* Extract of a letter from Messrs. Searle and Co., Agents to Lloyd's, at Fayal, dated the 9th of April, 1824:—"We have erected a Signal Post, and are prepared to communicate with such vessels in the offing as are furnished with the Code of Signals, (Capt. Marryat's.) when otherwise it would be impossible to have any correspondence with the shore."

On the 1st of May, 1808, a dreadful volcano, seen from Fayal, burst out about the centre of this island, in the midst of fertile pastures, about 3 leagues S.E. of Vellas. On the 3d, a crater was formed, in size about 24 acres. In two days, it had thrown out cinders or small pumice-stones, which a strong N.E. wind had propelled southerly; and which, independent of the mass accumulated around the crater, had covered the earth from one to four feet in depth, half a league in width, and three leagues in length: then, passing the channel, had done some injury to the eastern end of Pico. The fire of this large crater had nearly subsided on the 3d of May; but, in the preceding evening another small crater had opened, one league to the northward of the large one, and only 2 leagues from Vellas. The sulphureous smoke of the new crater rendered impracticable an approach to the large one. Within a mile of the crater, the earth was rent in every direction. The American consul of Fayal, who, with some friends, visited this place, states that, "they at length arrived within 200 yards of the spot; and saw it in the midst of a pasture, distinctly, at intervals, when the thick smoke, which swept the earth, lighted up a little. The mouth of it was only about 60 yards in circumference; the fire seemed struggling for vent; the force with which a pale blue flame issued forth, resembled a powerful steam-engine, multiplied a hundred fold; the noise was deafening; the earth, where we stood, had a tremulous motion; the whole island seemed convulsed; hollow bellowings were occasionally heard from the bowels of the earth, and earthquakes were frequent. After remaining here about ten minutes, we returned to town; the inhabitants had mostly quitted their houses, and remained in the open air or under tents. We passed the night at Vellas, and next morning went by water to Ursulina, a small sea-port town, two leagues south of Vellas; and viewed that part of the country covered with the cinders before mentioned, and which have changed the most valuable vineyards in the island into a frightful desert. On the same day (May 4,) the party returned to Fayal; and, on the 5th and succeeding days, from 12 to 15 small volcanoes broke out in the fields they had traversed on the 3d, from the chasms above described, and threw out a quantity of lava, which travelled on slowly towards Vellas. The fire of those small craters subsided, and the lava ceased running about the 11th of May; on which day the large volcano, that had lain dormant for nine days, burst forth again like a roaring lion, with horrid belchings, distinctly heard at 10 leagues distant, throwing up prodigious large stones, with an immense quantity of lava, illuminating at night the whole island. This continued with tremendous force until the 5th of June, exhibiting the awful, yet magnificent, spectacle of a perfect river of fire, (distinctly seen from Fayal,) running into the sea. On that day, the 5th, its force began to fail, and, in a few days after, it ceased entirely. The elevation of the crater from the sea was about 3500 feet. The lava inundated and swept away the town of Ursulina, and country-houses and cottages adjacent, as well as the farm-houses, throughout its course. It, as usual, gave timely notice of its approach, and most of the inhabitants fled; some few, however, remaining in the vicinity too long, endeavouring to save their effects, were scalded by flashes of steam, which, without injuring their clothes, took off not only their skin but their flesh. About sixty persons were thus miserably scalded, some of whom died on the spot, or in a few days after. Numbers of cattle shared the same fate. The consternation and anxiety were so great among the people, that even their domestic concerns were abandoned; and, amidst plenty, were in danger of starving. Supplies of ready-baked bread were sent from Fayal to their relief, and large boats to bring away the inhabitants who had lost their dwellings. In short, the island, heretofore rich in cattle, corn, and wine, is nearly ruined; and a scene of greater desolation and distress had seldom been witnessed in any country."

The CHANNELS among the AZORES, are, in general, clear and deep, and may be navigated at all times: that, however, between St. George and Pico should not be attempted, unless in settled weather, or with a steady breeze, for a sudden calm may prove fatal; as a strong current runs through the channel, according to the state of the tide.*

The PONTA DEL TOPO is the easternmost point of St. George's Island. This point lies W. $\frac{3}{4}$ N. [*W.S.W.* $\frac{3}{4}$ W.] 30 $\frac{1}{2}$ miles from the summit of Mount Brasil, in Terceira. It is of moderate height, with rocks around it, and near its eastern part is a low islet, likewise surrounded by rocks.

* And we suspect too, according to the state of the Florida-Stream, especially when it flows from a high northern parallel.—ED.

From Pta. del Topo to Pta. del Norte Grand, the north coast presents nothing remarkable. There are several breaks in it, but it is mostly low and regular. Hence to the west end of the island, Pta. de Rosales, it is more rugged and barren. Off the point last mentioned are several islets, of which two very high pyramidal ones are remarkable; one of these is at the foot of the point, and the other half a mile to the S.W. of it. To the W. by S., *true*, of Point Rosales, the pilots say that there is a rocky shoal of 7 fathoms. The sea may break over it in a storm.

From Pta. de Rosales to the *Morro Grande*, (Great Hill,) near the port of Velas, the coast trends S.E. by S. [*S.E. by E.*] The Morro is high, of a blackish colour, and has a viga, or look-out, on its summit. To the N.W. of the Morro, and on its skirt, is an indent of the coast, wherein several vessels have been lost, by mistaking it for the Port of Velas, the bottom being all rocky, and a vessel once in, cannot leave it without a change of wind.

PUERTO DE LAS VELAS.—At a mile and a half S.E. by E. [*E. by S.*] from the outer point of the Morro Grande is *Pta. la Caimada*, rather low, with a small castle. Between the two points is the Bay or Port of Velas, sheltered from winds from N.W., by the North, to S.E. In the bottom of the bay, on the shore, is the town of VELAS, or VELLAS, the chief town of the island; and on the S.E. side of this is a small mole, having 3 fathoms within it, but with rocky bottom. The regular anchorage is to the South [*S.S.E.*] of the mole, in 9 fathoms, fine black sand. Vessels moor with two anchors, to the N.W. and S.E. This is a place of little consideration.

From Point Caimada, on the eastern side of Port Velas, the coast by the sea continues low and rocky, but the land within rises to a good height. Thus it continues to the Pta. de los Monteros, the S.E. point of the island, which is high and sloped. Four leagues from the Bay of Velas is the *Point de Caleta*, whence a high mountain rises, with a gentle acclivity, and close to it, on the East, is a town of the same name, whence much wood is exported to the neighbouring islands.

GRACIOSA.—Graciosa is said to take its name from its beauty and fertility in corn, fruit, pasture, and cattle; supplying Terceira and several of the other islands with a great part of its produce. It is most fertile of all the Azores, and has about 8000 inhabitants, distributed in two towns and two villages. The greatest extent of the island is only $8\frac{1}{2}$ miles; but, in this extent, the quantity of barley which is produced is almost incredible, together with wheat, maize, wine, all kinds of fruits and vegetables. Of sheep, hogs, and fowls, the inhabitants have more than they can consume. The only scarce article is wood, for this is obtained from St. George's and Pico. The chief town is *Santa Cruz*, on the N.E. side.

Ponta Blanca is the S.W. point, and Carapacho the S.E. The mountains over these points appear at a great distance like islands, particularly on approaching the south side, from the S.W. Point Carapacho is low towards the sea, and has several islets about it; but, at a little distance inland, it is high and craggy. At two cables' length S.E. [*E.S.E.*] from the point is the islet *Abajo*, with others in its vicinity; but between it and the point the largest ship may pass, should it be necessary, to the anchorage of *Praya*, on the eastern coast.

Between the point Carapacho and Ponta dos Fanaes, one mile and a half N.E. $\frac{1}{2}$ N. [*N. 14° E.*] the coast is almost uniform and clear. At the last, the bay of *Praya* commences, the north side of which is *Pta. Negra*; the bearing and distance between are N. $\frac{1}{2}$ E. [*N. 15° W.*] a mile and a half. *Pta. Negra* is low and rocky, and near it stands the town of *PRAYA*.

An islet, called the *Isle of Praya*, lies at half a mile East [*E.N.E.*] from Point Negra: it is low on the west side, but rather higher on the east, and there is a passage between it and the point. At the distance of a cable and a half to the southward of the islet is the anchorage.

At three miles North [*N.N.W.*] from Point Negra is the Point of Josef Ferrer, which is very low, being even with the water, and having a dangerous shoal, at about two cables' distance, to the East [*E.N.E.*] The coast between these points is rather regular than otherwise, with a few little bights; of these bights, the first is close to Point Negra.

The best anchorage about the island is with the islet *Abajo*, lying near the S.E. point, in a line with the westernmost part of *Praya* Isle, or, rather, a little open; this is off

the southern extremity of a great slope of land, extending towards the point of José Ferrer. The depths are from 30 to 40 fathoms, sandy bottom. Here vessels load and unload, and are ready to be off with any winds, but they lie sheltered only from South by the West, nearly to North. All the goods from the town of Santa Cruz are brought to this anchorage to be shipped, as they have no other.

On the west of the point of José Ferrer is the bay and town of SANTA CRUZ. The coast is low, and the land rocky, with scattered fragments of rock about it. Close to the town, on the S.W. side, are three small hills near each other, and a church is on the highest part of every one of them. These, therefore, are good marks for the north side of the island.

The *Ponta da Pico Negro* is the north point of the island: it is high, oblique, and of a very black colour. The coast hence to the S.W. continues high and rocky. From the *Pta. de Fosso de Porco*, the Western Point, half a mile S.W. by S. [$S. 10^{\circ} W.$] is the Point of *Jorge Gomez*, low and rocky, with a church near it. Three miles and three quarters from that point is *Point Blanca*, very high and sloping, within which, at a short distance, is the highest mountain on the island. The coast between is of high rock. On the summit of *Pta. Frayle*, northward of *Point Blanca*, is a stone that resembles a man.

At S.E. $\frac{1}{2}$ S. [*S.E. by E. $\frac{3}{4}$ E.*] $2\frac{1}{2}$ miles from *Point Blanca*, is the low and rocky point of *Folgo*: the coast between forms a bay, and the village of *Folgo* is at the bottom of it.

CORVO AND FLORES.—These islands present nothing remarkable; they are of moderate height, intersected with hills, and may be seen, in clear weather, at the distance of 10 or 12 leagues. The surest guide will be an attention to their respective positions, as shown in page 20, and which will prevent their being mistaken for any other.

Mr. Luccock describes *Flores* as “a lively spot: it slopes to the east, and exhibits small inclosures, neatly walled and well managed; white cottages are every where scattered; the people are well made, ruddy, and healthy. They possess some of the social virtues; but even these lose their charms when accompanied by an unnatural simplicity and inanity of character. This, and its sister island, *Corvo*, when seen from the N.E. exhibit a singular appearance. The first resembles a large lizard, lying upon the water; the latter a tortoise; and the outlines and proportions of both are agreeably to nature.”

CORVO has a small port, and is said to contain about 750 inhabitants. Its produce is wheat, the best in the islands, rye and yunsa, of which they make bread, mixed with the rye. Cattle, sheep, and hogs, are sufficiently abundant; but water and wood are scanty.

There is a mountain at each extremity of the island, so that the land, when viewed from N.W. or S.E., appears in the shape of a saddle. The southern point, *Pesquero Alto*, is low and rocky. At a mile and one-third E. $\frac{3}{4}$ S. [*E. by N.*] from this is the *Ponta de Puerto Casa*, of middling height; and close to the latter, on the north side, is the anchorage of *Puerto Casa*, in which there are 25 and 30 fathoms, good holding ground.

The whole of the eastern side is of high land, declining toward the sea. The north side is also high and sloping, but the coast is regular; nearly midway on this side is a rock, at a cable's length from land, over which the sea breaks. Halfway down the western side is *Pta. Blanca*; the coast is here very high, with some declivity towards the sea.

At a mile and two-thirds from *Point Blanca* is the south point of the island, already noticed; the coast between forms a bay, in which is a small beach, connected to a high islet: W.N.W., *true*, from this is anchorage in 30 fathoms, sandy and good-holding ground sheltered from easterly winds.

In the CHANNEL between *CORVO* and *FLORES* there is a great depth of water: it has no shoal whatever, nor any hidden danger.

FLORES.—This island contains about 7000 inhabitants. It has two towns, both on the eastern side, *Sta. Cruz* and *Lagens*, and four villages. The chief productions are inames, wheat, of excellent quality, cattle, sheep, and hogs, cloths, and woollen stuffs.

The exports are wheat, cloths, bacon, with the weed or moss called Orchilla, used for a dye, as already noticed. The latter is found clinging to the rocks and declivities, and is not obtainable without great trouble and danger.

The island is very mountainous, but much more so towards the south than the north. The town of Santa Cruz is in latitude $39^{\circ} 29'$; and to the N.W. of it, in the interior of the island, is a remarkable peak. The land is well cultivated, and has abundance of water, falling down, in numerous cascades, from the heights.*

Of PONTA DEL GADA, the north point of Flores, the position is shown in the Table, page 20. This point is of moderate height, smooth on its summit, not very projecting, but at its base is a cluster of islets, extending outward a quarter of a mile; the ground around them is clear.

PONTA RUIVA, the N.E. point of Flores, is high, sloped, rugged, and obtuse. At the foot of it is an islet, called the *Pan de Azúcar*, or Sugar-loaf: a fishing-boat may pass between. In the bay to the westward of Pta. Ruiva, there is anchorage in 25 fathoms, sandy ground, sheltered from winds from S.E. by the South, to W.S.W. It is frequently resorted to for water, or by vessels that are compelled by the wind to quit the eastern side of the island.

The *Point of Santa Cruz* is $2\frac{1}{2}$ miles S. $\frac{1}{2}$ E. [S.S.E. $\frac{1}{2}$ E.] from Point Ruiva. It is low and rocky, with several rocks about it. In the interval is the islet of Alvaro Rodriguez, very near to the coast; and to the S.E. [E.S.E.] of this is anchorage, in 36 fathoms, sandy bottom, sheltered from the West and S.W. At true South, three-quarters of a mile from the point, is the castle of SANTA CRUZ, which is very near to the town, the principal port of the island.

At a mile and three-quarters southward from the castle of Santa Cruz, is *Ponta Cabeira*, low and rocky land, which rises with a gentle acclivity to the distance of a mile. Between these points the coast forms a bay, with a beach and a small river at the bottom of it. This bay is the best anchoring-place about the island, and is sheltered from all points between N.N.E. by the West to S.W. The proper depths are in from 35 to 40 fathoms, sandy ground. This is the nearest anchorage to Santa Cruz, and therefore the most frequented.

At a mile and a half S.W. $\frac{1}{2}$ W. [S.S.W. $\frac{1}{2}$ W.] from Point Cabeira is that of Loma, which is high and oblique; between these points the coast forms a bay, with a beach and small river at the end of it. A vessel may anchor in this bay, in 25 fathoms, sandy bottom, but it is not so well sheltered as that to the northward, being open to easterly and southerly winds.

From the Point of Lagens, which is 4 miles to the south-westward of Point Loma, a ridge of rocks extends to the distance of a cable and a half to the S.S.E. At $2\frac{1}{2}$ miles S. $\frac{1}{2}$ W. [S. by E. $\frac{1}{2}$ E.] from Point Lagens in a rock or shoal, of $4\frac{1}{2}$ fathoms: its size is about that of two ships, and appears, when near to it, like a large flagstone. Between it and the coast is a great depth of water, and the same about it.

In the little bay, on the north side of Lagens Point, is the town of LAGENS, having a large church, which is a useful mark for this part of the coast. A vessel may anchor very well in this bay with a wind between North by the West to S.W. by W. in 25 fathoms, sandy ground. This anchorage is much frequented, because a vessel can here get underway more easily than at Santa Cruz, having better room for working out.

From Lagens Point westward, the coast rises in height to the *Point de Roca Alta*, at a little distance from which, towards the north, is the highest part of the island. The Point of Lope Bas, which is nearly a mile W.N.W. $\frac{1}{2}$ W. [W. $\frac{1}{2}$ S.] from Lagens Point, is low by the sea, but within, high and sloping. That of Roca Alta is a mile and a half farther, is obtuse, very high, sloping, and black. The coast here is nearly straight, high, and rugged.

The *Ponta de los Ilheos de Agua Caliente*, which is low and rocky, is so called from a mineral spring which exists here, and of which the water is hot. Between this and the point Roca Alta is a bay, with anchoring ground in 25 fathoms, sandy bottom. There are several islets at the foot of the former point.

* The anchoring ground about the island is generally at without the distance of a mile from land. Within that distance the ground is rocky, and much farther out it is the same.

The *Pta. de Catarinas*, with its islets, lie at a mile and a third more to the northward. The coast between is wholly rocky. At a mile and three-quarters farther, to N.N.E.; is *Pta. dos Bredos*, high sloping land, of a whitish colour, with islets at its base. One of the latter, on the south side of the point, resembles a column. The coast between affords anchorage, in 20 or 25 fathoms, sandy ground.

The *Pta. del Baxio*, which is very low, is $2\frac{3}{4}$ miles to the northward of *Pta. dos Bredos*. The coast between is rocky, but you may anchor off it in 32 fathoms of water, sandy ground, and sheltered from N.N.E., East, and South. Close to Baxio or Shoal Point is a very remarkable church; that of S. Pedro, or St. Peter.

At $2\frac{1}{2}$ miles N.N.E. $\frac{1}{2}$ E. [N. 6° E.] from Baxio Point, is that of Fanaes, which is not very high by the sea, but it forms abruptly like a mountain, and is of a black colour. The bay in the interval is that of San Pedro, which has anchoring ground, in 25 or 30 fathoms, bottom of sand; and here water may be readily obtained from a cascade that falls from the mountains, by means of a hose, so as to fill the casks without taking them out of the boat. The Islet Monchique lies at rather more than a mile N.W. $\frac{3}{4}$ W. [W.N.W. $\frac{1}{2}$ W.] from Point Fanaes. The depth between is sufficient for any ship.

PONTA ALBERNAS is the N.W. point of Flores. It is moderately high, sloped, and of a red colour. Between it and Point Fanaes is the islet of *Maria Gadella*, which is high and round. W. $\frac{3}{4}$ N. [W. by S.] from this islet is anchorage, in 30 or 40 fathoms, sandy ground. From the point eastward, to *Pta. del Gada*, already described, the coast is entirely rocky.

DESCRIPTION OF A VOYAGE FROM THE WEST INDIES TO THE AZORES, in the *Hornby*, Capt. Walker, 1818. By Lieut. Jas. Hackett.

On the 29th April, 1818, at about three o'clock in the afternoon, we sailed from Basse-terre Roads (St. Christopher's), steering a N.W. course, with a gentle easterly breeze, and, with feelings of pleasure to which we had long been strangers, observed the town and shipping gradually recede from our view, and diminish into obscurity. Shortly after dusk we were close in with Eustatius; and, on the ensuing morning (the 30th), the islands of St. Martin and Anguilla were discernible; early in the afternoon, Dog Island bore faintly in sight to the N.E., from which we took our departure, and bade a final adieu to the West-Indies.

Having now cleared every obstruction, and being once more afloat upon the wide Atlantic, we set all sail, and steered a N.E. course. With the exception of a few slight squalls, accompanied by much vivid lightning, we experienced an uninterrupted continuance of fine weather, and favourable though light winds, which enabled us to carry our studding-sails nearly the entire voyage to the Azores; which islands we made on the 26th of May, without having once had occasion to put the ship about.

So favourable a passage has probably been rarely experienced from the West-Indies, and was to be attributed, independently of the season, to our course, which varied considerably from that generally adopted by vessels homeward-bound from the Windward Islands. The masters of West-Indiamen, almost uniformly, in the first instance, proceed nearly due north until they reach the Bermudas, whence they take a fresh departure, and steer direct for England: but Captain Walker aware of the incompetency of his crew to contend with the bad weather, heavy gales, and fogs, usually experienced off the Great Bank of Newfoundland, judiciously deviated from the customary track, and stood to the N.E. by E., (*true*) keeping the ship as close as she would lay to the southward and eastward; by which means he was enabled to fetch the Western Islands, so unfrequently touched at, except by vessels for the immediate purpose of commercial traffic.

Of these islands, the first land made was Pico, whose lofty summit was, by the ship's log, discernible at the great distance of twenty-four leagues; and, on our approach, the following day, presented an appearance inconceivably bold and majestic; its insulated situation, extreme elevation, and luxuriant scenery, combining to form a view of the most impressive grandeur.

The peak was seen proudly towering above massy clouds, which, hanging upon the steep sides of the mountain, at intervals occasioned a partial obscurity, and even sometimes appeared to envelope the base itself.

As we bore up abreast of the channel which separates the island from Fayal, the density of the atmosphere became less intense, and the clouds gradually dispersing, as the sun advanced above the horizon, the celebrated peak was shortly after visible in all its sublimity; a few light clouds still hovering around its summit, increasing the general interest of the scene. Its extreme height is generally estimated at upwards of 7000 feet above the level of the sea, and cultivation appeared to have been carried to within about one-third of the summit. These lofty regions were not only unsubdued by human industry, but apparently destitute of even the slightest vestige of natural vegetation. Here nature reigned in the midst of the most picturesque and barren wildness, more strikingly interesting, as contrasted with the luxuriant fertility of the lower and inhabited districts. The entire island seemed devoted to the growth of the vine, which rendered its appearance rather gloomy and sombre; enlivened, however, by the white cottages of the peasantry, the monasteries, churches, and a few other elevated buildings.

Owing to the lightness of the wind, we were unable to make Fayal so early as we had expected, and it was five o'clock in the afternoon before we anchored in the road of Orta, the capital of that island. The prospect which unfolded itself, as we approached the harbour, surpassed in natural beauty any thing I had ever before witnessed; equal to the most highly cultivated pleasure-grounds in England. The island, throughout, exhibits a charming variety of scenery, and its features were, in many parts, in the highest degree romantic.

The weather being so uncommonly calm, and the sea free from the slightest ruffle, I attempted to make a few sketches, but never before more sensibly felt the inadequacy of my pencil to do justice to the captivating scenery which successively presented itself.

As the vessel sailed round the point, and entered the roads of Orta, the prospect was peculiarly fine. The town is built close to the shore, and, viewed from the harbour, has the appearance of considerable magnitude and importance, owing principally to the great number of religious buildings conspicuous in every direction; and which, on first appearing before the little city, give it an air of architectural magnificence, of which, with the exception of the monasteries, churches, and a few private houses, a more minute acquaintance proves it to be totally devoid.

Shortly after the Hornby entered the roads, the revenue officers, attended by a strong military guard, came on board; but, after examining our papers, and going through the usual forms, retired, leaving two officers in charge of the vessel, and granting us unrestricted permission to go ashore whenever we pleased. Of this indulgence we soon availed ourselves, accompanied by one of the officers for a guide. It was now fast approaching to twilight, the evening serene, and the convent-bells chiming with the most plaintive solemnity for vespers. Our conductor led us through the principal parts of the town, pointing out the various objects deserving attention, and describing the different religious orders to which the numerous monastic structures, &c., respectively belonged.

The height of the houses seldom exceeds two stories, and these are built principally of a close blue granite or lime-stone, with which the island abounds: it is capable of being worked to any degree of ornamental richness, and can be raised in blocks of considerable magnitude, presenting, when wrought, a durable and handsome appearance. The windows, which, at the time of Captain Cook's visit, were merely latticed, are now universally furnished with glass; those of the second story have likewise trellis-work balconies generally attached to them, where the inhabitants usually resort to enjoy the mild and salubrious evening temperature. The principal street, which runs nearly parallel with the shore, and extends throughout the whole length of the town, is irregular, in many parts narrow, roughly paved, and without foot-paths.

Orta, although formerly a place of considerable strength, cannot at present be said to be well fortified, as the works have, in many places, been permitted to fall into decay. Its chief defence consists in three forts, two of which cover the principal landing-place at the south end of the town, and are strongly garrisoned: the other, situated at the northern extremity, appears to be of minor importance, and is less attended to. An old wall and rampart, nearly in a ruinous state, extends along the front of the town,

ill calculated, in its present condition, to afford protection, and without a gun mounted on any part,

The monasteries and convents partake, principally, of the Moorish style of architecture, and consist chiefly of a lofty and ornamental white front, terminating in the centre in a curved line pediment, containing some emblematic religious device; a square tower at either side, with circular-headed windows, black quoins, cornices, belting courses, &c., and surmounted by Turkish or Arabic turrets. The rear presents nothing more than a plain building of rough masonry.

The Jesuits' college was originally a fine and graceful structure, but is now partly in a state of dilapidation; such parts as still remain habitable have been converted into government offices and king's stores. This building is situated on an eminence towards the north end of the town, and has an imposing appearance.

During our perambulations through this little city, the only interruption to the placid stillness of the evening was the tinkling of guitars, which proceeded from almost every house, and appeared to be the general pastime of the inhabitants. After nightfall the Portuguese seldom go abroad; the few we met were wrapped up in large blue cloaks, and walking with an air of the most solemn gravity. About ten o'clock we returned on board, but early on the ensuing morning again proceeded on shore. This being market-day, the peasantry were crowding in from all parts of the island with various articles of provision, consisting of butter, eggs, poultry, &c., which were to be had remarkably cheap. The men exhibited much of the appearance of the hardy mountaineer, inured to the fatigues of toilsome and laborious industry. Cleanliness, good order, and contentment, seemed to characterise the women, whose peculiarity of dress, healthy appearance, and apparent artlessness of manners, give them an air of the most interesting rustic simplicity.

I was informed that the inhabitants of Fayal, and of the Azores in general, enjoy a life of the most social and domestic happiness; and are far superior, both in elegance of manners and liberality of sentiment, to the generality of Portuguese resident on the continent of Europe. On proceeding a short distance into the interior, the scenery fully justifies my prepossession on landing. The luxuriant evergreen *Faya* (from which the island is said to have derived its name) grows unheeded in almost every direction. The gardens possess a combined assemblage of tropical and European trees; that of the American consul was a perfect little paradise, presenting the interesting novelty of the orange and banana flourishing in the same soil beside the apple and other fruits of common English growth. The different compartments were inclosed by hedges of geranium, bearing a full-blown scarlet blossom, in appearance particularly rich and beautiful.

An intimation from Captain Walker, that the vessel was ready for sea, precluded the possibility of extending our excursion so far into the island as we intended, and with much regret we were compelled to return on board.

Through the zealous attention of the British consul (Mr. Parkins), who procured for us during that day every necessary we stood in need of, the Hornby was, by five o'clock in the afternoon, cleared out, and once more ready to proceed on her voyage. About six we weighed anchor, and steered a N.E. course, close by the west point of the island of St. George; next morning observed Graciosa bearing E. by N., and at 11 o'clock passed within four miles of it. Its general appearance was rather barren, presenting a brown turf-like soil, and much covered with heather; towards the S.W. end, the shore bluff and rocky, against which the sea beats with much violence, and breaks to an immense height; the interior of the island is mountainous.

4. THE MADEIRAS.

PORTO SANTO, &c.—Ships from the ports of Europe, when bound to Madeira, are recommended to make, in the first instance, the Isle of PORTO SANTO, and thence proceed for the Road of Funchal, on the track shown upon the particular plan given in the Chart. The land of Porto Santo is very remarkable, and may be seen, in fine weather, 15 or 20 leagues off. It first appears in two or three very high hummocks, by which it is distinguished from Madeira, and the little isles named the *Desertas*. On the S.W.

side is a small town and good road, where water and refreshments may be had. This road is described as, in some respects, better than that of Funchal. The position of the isle is shown in the Table, page 21.

To the northward of Porto Santo there is a ledge of rocks, the position of which was ascertained by the officers of his Majesty's sloop, *Falcon*, Lieut. J. Bowen, in January, 1802. The least depth upon them, according to the observations then taken, is $4\frac{1}{2}$ fathoms. They are steep-to, and lie at the distance of 8 miles from the northernmost point of the island, with the N.E. point of Porto Santo bearing S.S.E.; the *Ilheo da Fonte*, or northernmost rock, S. by W., and the west point of the island S.S.W.

The bank extends east and west, *true*, nearly a mile and a half, terminating in a reef to the westward. The shoalest part, supposed to be a pinnacle rock, lies as above, or *nearly so*, the boat in which the bearings were taken being agitated by the sea.

There can be little doubt that this is the reef, formerly said to lie 3 leagues to the N.E. of Porto Santo, on which a Dutch ship was lost.

A bank of rocks, on which the least depth is 40 fathoms, lies about three miles to the E.S.E. of the *Ilheo de Serra*, the south-eastern islet of Porto Santo.

DESERTAS.—The little isles, called the *DESERTAS*, on which there are a few fishermen's huts, are barren fragments of rock and earth, represented as lying nearly in a North and South [*N.N.W.* and *S.S.E.*] direction. At the distance of 10 leagues, and bearing W. by N., they appear separately; the northernmost long, high, and nearly even: the southernmost, called the *Bujio*, in two hummocks, nearly as high, and about two-thirds of the length of the former. At the distance of 6 or 7 leagues, a small islet off the northern extreme becomes discernible, like a low wall: close to this is a high rock, the *Pyramid*, frequently mistaken for a ship under sail. Several outward-bound West-India ships were dashed to pieces, a few years since, by running on the *Desertas* in the night; the consequence of an error in dead-reckoning.

Between the *Desertas* and *Madeira* is a clear passage, eight miles broad, having no soundings, except at 50 or 60 fathoms, almost close over on the *Madeira* side. In the season of the breezes, (the N.E. winds, which prevail in summer,) a strong current sets through this passage to the south-westward.

The passage between the two *Desertas* is clear, though bounded on each side by breakers, or rather by a surf; but it should not be attempted, unless from necessity, as it is very narrow, and has no soundings, or at least very deep water, in it; and a ship is subject to be becalmed in it by the northern *Deserta*, which overlaps the *Bujio*. This happened to a vessel of about 200 tons, which came through it in the night, having mistaken it for the broad passage to the northward.

MADEIRA.—The island of *Madeira* is very high, excepting the eastern end, which is a low rugged point: yet it is often so entirely clouded over as not to be visible at the distance of 5 leagues. But, when abreast of Porto Santo, the island commonly appears as one great mountain, with its summit hidden in the clouds. Shortly after appear the *Desertas*. Having passed those islands, you will soon perceive the ships in the Road of Funchal; and, from their riding, it will be seen how the wind is in the road, as it is common to have a strong breeze from N.E. or E. on passing the *Desertas*, when, at the same time, the wind, in the road, is from the S.W. or W.S.W.

When sailing in toward Funchal Road, a large rock, named the *Loo Rock*, with a fort on it, will be seen on the West side of the road, a little to the westward of the town. With this rock, N. by E., when in 38 or 36 fathoms, let go the larboard-anchor, with two cables on it; for, should there be a fresh breeze from the eastward, it will be scarcely possible to bring up until the splice is veered a good way out. It is requisite to ride in the road with a whole cable, and with a splice so situated that you may be able to cut near it, should circumstances unfortunately compel you to put to sea without weighing anchor. While riding, keep a slip-buoy on the cable, have a kedge-anchor and a nine-inch hawser to the westward, to keep the ship steady, with the hawser on the starboard bow, as the wind generally veers from the eastward to S.W. and W. When the land-wind makes a cross, the end of the hawser may be shifted.

The general anchorage is in from 30 to 35 fathoms, with the citadel (called the *Peak Castle*, a brown square fort on a hill over the N.W. part of the town) a little open to the eastward of the *Loo Rock*; the latter at the distance of half a mile.

With the Loo Rock and citadel in one, bearing nearly N.N.E. $\frac{1}{2}$ E. and Funchal Steeple N.E. $\frac{1}{2}$ N., the anchorage appears equally good, in 35 fathoms, stiff ground. With the same marks, with the Loo about a mile off, there is good ground in 45 fathoms. To the westward, the ground changes to sand and rock, and to the eastward it has a sudden declivity from 50 to 55 fathoms, stiff clay ground, to 100 fathoms, rock, and then no ground.

In case of a S.W. gale, which may be frequently expected in winter, the situation with the Loo and citadel in one, or the citadel just open to the westward of the Loo, will be found most convenient. On the contrary, the citadel will open to the eastward of the Loo, is the best situation when a south-easter may be expected.

When coming into the road, with a brisk wind, sail should be reduced and secured in time, to prevent having too much way through the water, at the moment of anchoring: and ships should be brought up with their heads to seaward; for thus, in case of any accident in bringing up, sails may be had off shore, or otherwise, as required.

Mr. Finlaison, who wrote his remarks in 1821, has said, "It is generally reckoned the best anchorage for ships with the Brazen Head E. by S., Point de Cruz W. by N., Loo Castle N.E.: but I would recommend ships to anchor at a good quarter of a mile to the westward of these bearings; as I am convinced that here is better holding ground, and clear of anchors. Ships should not anchor farther to the eastward than to bring the high fort [Peak Castle] on the west end of Loo Castle. With the fort open to the eastward of Loo Castle the ground is rocky and has in it many anchors.

Those riding in Funchal Roads should be very active when they observe a swell coming in from the S.W.: at this moment no time is to be lost in getting under-way, for the swell indicates that a gale is certainly coming on; particularly so in the months of December and January, generally the commencement of the rainy season. Should it come on to blow very hard from the westward, the best mode is to run to leeward of the Desertas, where shelter from the wind may be found, and water perfectly smooth: thus you avoid the risk of losing sails, by heaving to windward." *Variation* $19^{\circ} 20' W$.

Off the valley of Funchal, there are regular land and sea breezes, particularly during the summer; the sea-breeze sets in from the south-westward some time in the forenoon; the land breeze comes off shore about ten o'clock at night, sometimes later, even to two or three o'clock in the morning: these breezes do not extend above 3 or 4 miles off shore; but, when it blows fresh in the offing, there is generally a counter-breeze in the stream of the Valley of Funchal; unless it blows hard, when the true wind prevails also in the road.

There is generally a surf on the beach, early in the year particularly, which prevents landing in a ship's boat any where, except within (to the north-westward of) the Loo Rock, about half a mile from the town; therefore, the boats of that place are employed for goods, watering, &c. The tides rise and fall about $7\frac{1}{2}$ feet; and the current along the south side of the island seems to be always governed by the true wind in the offing. The rainy season is in January, February, and March; October is also frequently a wet month, as well as November and December.

The road is open from the West to the S.S.E. The winds blow strongest here when from S.W. to S.E. Ships anchoring in the road in winter must be guarded against the consequence of a dark gloomy appearance of the atmosphere to the southward, with a swell setting in; for it is very dangerous to remain at anchor with those prognostics.

Squalls sometimes come fresh off the land: there is one instance of a hurricane down the Valley of Funchal blowing every ship out of the road, which was so violent, that the ships were hid from the town by the spray of the sea, although in a clear sun-shining day.

The best way for ships, however large or numerous, when bound into Funchal Road from the eastward, with the wind N.easterly, is through the passage between the Desertas and Madeira. The N.easter will carry them to the offing of the Brazen Head, the East point of the Bay of Funchal. In the night, a single ship may keep over towards that bluff point, and, with her boats towing a-head, when becalmed, luff up into the stream of the land-wind, and by that means fetch the anchorage. Ships must shew light at their ensign-staff in the night, to prevent being fired at from the forts and Loo-castle. In the day, they should keep farther distant from the land than in the night, to avoid being becalmed under it, and to gain the stream of the sea-breeze. If, from over caution, or other reasons, they fall 2 or 3 leagues to the leeward of the road, they should then

then keep plying up in the stream of the valley, until they gain the vein of the sea-breeze. In working in with a land-breeze, it is best to make short tacks opposite the valley; as here both the land and sea-breezes are most regular.*

Small vessels, from North-America and the Western Islands, come in, generally, round the west end of the island; but are frequently becalmed a considerable time under the high land there. From this reason, ships, on leaving Funchal, should make sail with the land-wind, and stand directly off from the road. Ships bound to the southward, by taking a contrary method, have continued several days becalmed under the western part of the island.

In the winter-months, eddy-winds and squalls, proceeding from the high-land, are frequent and severe, and ships are often forced to put to sea from the road. Severe westerly and S.W. gales, with rain, then frequently prevail, and prevent regaining it for some time. At these periods, Madeira and the Desertas are often obscured in fog. The squalls have been found so sudden and violent near the Desertas and about the S.E. end of Madeira, as nearly to overset the ships in the vicinity: and many have been driven by them far to the eastward.

With a gale at S.W., and a high sea rising, off the S.W. end of Madeira, a ship in November, 1797, bore away to find shelter under the lee of the island; the weather dark with rain. Between Madeira and the Desertas, this ship was suddenly becalmed; then followed an eddy-wind from N.E., and the sea frequently over the bowsprit and jib-boom. A dark cloud was now over head, and the ship near the land of Madeira. At this time two ships were seen 2 or 3 miles to the eastward, in clear sunshine, running before a sharp squall at S.W.

It has been said that, a southerly wind never blows hard quite home to Funchal, that the south-westers and south-easters are never expected unless in January, February, and the beginning of March; and that large ships almost always ride them out; but Captain Horsburgh has stated, that "these southerly gales sometimes blow quite home to Funchal, even in November and December; and, when they are apprehended, it is common for ships of every description to put to sea. These S.W. or S.E. gales are, in general, preceded by a swell in the road, often accompanied by gloomy weather, drizzling rain, and a very unsettled breeze from the land, veering backward and forward very suddenly. Under such indications, ships generally proceed to sea:" for, should it blow strong from the southward, it would be almost impossible to clear the shore; the anchorage being so close to the land. A few years ago several vessels were driven from the anchorage, and completely wrecked on shore.

The regulations of the port of Funchal require all ships before or immediately on anchoring, to acquaint the governor of the island what they are, and their reasons for stopping there. Ships of war are not to send their boats to vessels coming into the road, until they are visited by the pratique-boat, a boat manned by persons appointed to enquire if any infectious disorder is on board. The same is to be observed respecting vessels that are departing, which are not to be boarded after the visiting officer has been to search for natives attempting to leave the island clandestinely, and for prohibited goods. English ships of war salute with thirteen guns, after an assurance of an equal return.

* Captain Mackellar, R.N., says, in his Journal, "Of Funchal Roads, I shall only observe, that, in running for the island, it is necessary to give the North end sufficient room; so as, by nearing the land too much, you may not be becalmed, and thereby drift to leeward of the Roads, observing to open out the anchorage well before you haul in; and, if possible, drop anchor to the southward of the Loo Rock, in about 30 or 35 fathoms, nearly off the centre of the town; but frigates and smaller vessels may go close in shore, and anchor in 20 or 25 fathoms: my reason for choosing this anchorage is, that there is a truer land-wind to get under weigh with, and a better drift, should you bring your anchor home; which, from the steepness of the bank, and the badness of the ground, often happens.

"The usual place of landing is the steps at the Loo Rock; and, though landing here is attended with some difficulty when the sea-breeze sets in, it may generally be effected without much danger: in moderate weather the beach may be landed on. but I strongly recommend landing in the island boats. Refreshments of all kinds may be had, the prices depending much on the seasons, and the number of vessels in the Roads. In leaving Madeira, you should do it during the night, or early in the morning, as then the land-wind blows right off, and you drift to sea, without risk, giving you time thereby to stow your anchors, and clear the land before the sea-breeze sets in."

The boats may land on the beach in summer: but they are driven by a violent surge on the shore, which is shingly. The landing near the Loo-Rock, before mentioned, is safe and easy, being defended from the surge.

It is necessary to be cautious of the shore-boats, which will come to the ship to sell fish, fruits, and vegetables, as their chief object is often the sale of the worst spirituous liquors to the seamen, and sometimes concealed goods. Fresh beef, water, and vegetables, are to be procured here for the ship's company, and are sent on board in boats belonging to the place.

There are two other anchoring-places on the south side of the island; one is off Santa Cruz, which is exposed to the N.E. winds; the other is to the westward, where ships are commonly sent to perform quarantine. The beach of the Quarantine-Road, as also that of Funchal, is of blue stones and black sand.

The PONTA DE SOL, (*Sun Point*), about $3\frac{1}{2}$ leagues to the westward of Funchal, is a perpendicular and majestic cliff, which, in a westerly gale and stormy weather, often appears surrounded by the colours of the rainbow. In the small bay to the eastward of it is the anchorage above mentioned.

ABSTRACT, on SAILING to and from FUNCHAL, in H. M. Ship INVESTIGATOR: by Captain MATTHEW FLINDERS, 1801.

Aug. 1, At noon, Porto Santo bore N. 11° W. true, and the rocky islands called the Desertas from N. 65° to S. 85° W. (true) distant 5 leagues.* The south end of these islands lies, by our observations, in latitude $32^{\circ} 24' 20''$ N., which differs less than one mile from its position in Mr. Johnston's chart of the Madeiras.

There being little wind next morning, I went off, in one of the cutters, to the southernmost island, called Bujio, which was not far distant. The distance, however, proved to be more considerable than was expected; and there being a current setting southward,† we did not reach the shore until near three in the afternoon, when it was necessary to think of returning.

A small ledge of rocks, which projected a little from under the cliffs at the S.W. part of the Bujio, afforded a landing-place; but it was impossible to ascend to the top of the island. We saw no other animated beings than a few birds, something like green linnets, but which were said, at Madeira, to have been canary-birds; and the other productions were scarcely sufficient to afford amusement, even to a naturalist. The cliffs over-head showed marks of irregular stratification, and in some of the lines there was a red tinge, apparently of iron. The base underneath was black and honey-combed, as if it had been in the fire, resembling, in this respect, the common stone at Funchal.

We left the Bujio well satisfied that, so far as we could judge of the islands, the name Desertas, or Desert-Islands, was well-chosen; and, soon after dusk, reached the ship. There was then a good breeze from the North-eastward, with which we steered for Madeira, tacking occasionally during the night, to take advantage of the different flaws of wind. At the following noon the ship was under Brazen-Head, which forms the east side of Funchal Road; and, being there becalmed,‡ we towed in with the boats, and came to an anchor at four o'clock, in 22 fathoms, steadying with a kedge to the N.W. In this situation, which seems to be as good as any in the road, the bearings (by compass) were as follow:—Brazen-Head, S. 71° E.; Punta de Cruz, on the western side, N. 85° W.; and Loo Fort, distant one-third of a mile, N. 12° W.

The north-east winds usually prevail at Madeira in the summer-season, and sometimes blow very strong. To reach Funchal Road, ships are accustomed to sail, between the East end of the Madeira and the Desertas, before the wind. They are not very desirous of passing close to Brazen-Head, where they would be becalmed, but keep off a mile

* Captain Flinders says three leagues, but this appears to be incorrect.

† Perhaps, also, a little easterly.—Ed.

‡ A common occurrence when entering this way, as shown in the preceding page, 207.—Ed.

or two, in the skirt of the north-east wind, until they are off the town, or even off Punta de Cruz, where they generally find a breeze from the S.W., which takes them to the anchorage. This S.W. wind is the sea-breeze of Funchal; and, during the time we lay in the road, it usually set in at eight or nine o'clock in the morning, and prevailed as far as three or four miles in the offing till sunset. A variable breeze comes off the land in the night, at which time it is recommended to ships to pass close to Brazen Head, and tow into the road.

"On the 6th, in the evening, the scientific gentlemen returned from an expedition towards the *Pico Ruivo*, which is the highest of a ridge of mountains occupying the central parts of the island, and is said to be 5067 feet, or nearly an English mile, above the level of the sea. The ascent was found to be very difficult; and this, with the heat of the weather, and limitation of their time to this evening, disabled them from reaching the summit. It was late when they arrived at the shore; and, in embarking, abreast of the town, they had the misfortune to be swamped, and to lose the greater part of their collections and sketches, although the boat was managed by Portuguese watermen, accustomed to the place.

"The best landing is behind the Loo Rock; but the stoney breach, in front of the town, is usually safe in the summer-time. It was so on our first arrival, until the strong eastern winds, in the offing, raised so much swell as to make it dangerous, even for people experienced in the management of a boat in the surf.

"The town of Funchal is placed at the foot of a mountain, which projects from the great central ridge; and the houses, being mostly white, they form a strong, but agreeable, contrast with the back land. At different elevations, up the side of the mountain, are scattered the country-houses of the richer inhabitants, placed among groups of trees, and surrounded with vines. These, with a convent dedicated to *Our Lady of the Mountain*, which, like the houses, is white, but partly hidden by foliage, give the whole a picturesque and pleasing appearance from the ships in the road. The town is larger, and there was more trade and activity in it than I was prepared to expect in a small colony, where the students of the college, and ecclesiastics of different orders, form no inconsiderable part of the superior class of inhabitants. Several British merchants reside at Madeira; their houses of business are at Funchal, but their favorite residences are upon the side of the mountain.

"Wine, water, and fresh beef, were the supplies procured at Madeira. Wine for the ship's company was charged at the enormous price of 5s. 8d. per gallon, and the beef at 10d. per lb.; I therefore took only small quantities of each. For good Madeira we paid as much as £42. the pipe. Fruit and onions were in abundance, and, probably, were not of less advantage to the health of the people than the more expensive articles.

"On quitting Funchal Road, (August 7,) we were taken aback, at two o'clock, by the E.N.E. wind, about two miles off Brazen Head. It blew so strong as to make it necessary to clue down all the sails; and, until next morning, nothing but close-reefed topsails could be carried with safety. At noon, the log gave 162 miles from Funchal; but the cloudy weather did not admit of taking observations."—For Captain Flinders' position of Funchal Road, see pages 21, 22.

Mr. Prior, in his relation of a voyage made in the *Nisus* frigate, Captain Beaver, has given a description of Madeira: in this, he says, the land, rising abruptly from the water's edge to a considerable height, topped with wood, and the sides variegated by a luxuriant vegetation, intermixed with vineyards and detached white houses, combine to produce the happiest effect. The illusion, however, vanishes the moment you enter the town of Funchal, the only one in the island; for here, instead of meeting with nymphs, shepherds, and enchanters, the eye reposes on bald-headed monks and bare-legged peasants, &c., narrow uncouth streets, strewn with dirt and decayed vegetables, sequestered houses, which look like prisons, a few churches, built without taste, some ill-looking store-houses, and other objects, which it is not requisite to describe.

The well-known salubrity of the climate, Mr. Prior adds, occasionally invites some of our countrymen here, as invalids, from their native frosts and fogs, when assailed by complaints of the lungs; and, admits that it is frequently useful; but, "with regard to enlightened society, or liberal institutions, either public or private, they must submit to many privations. The resident English merchants, however, support, as they do every where, the national character for liberality."

5.—THE CANARIES, OR CANARY ISLANDS.

THIS group of islands, supposed to be known to the antients under the name of the FORTUNATE ISLANDS, were neglected by the moderns until the year 1402, when Jean de Béthencourt, a baron of Normandy, took possession of Fortaventura and Lanzarote, for John, king of Castile. By the treaty of peace between Ferdinand, king of Castile, and Alphonso, king of Portugal, it was agreed that these islands should belong to Spain, in lieu of the settlements on the continent of Africa, ceded to Portugal.*

The land of these islands is generally high, being variegated by volcanic mountains, among which that called the Pic, or Peak, of Tenerife, is supereminent. The inequality of height is, however, so great as to produce differences in the temperature of the different islands. For eight months in the year the summits, excepting those of Lanzarote and Fortaventura, are covered with snow; yet in the valleys, and on the shores, the cold is seldom so great as to render fires necessary. A great proportion of the surface of the islands is covered with lava, calcined stones, and ashes, formerly emitted by volcanoes, the remains of which are still visible in all the islands; and some of them, among which is the Peak of Tenerife, are not yet entirely extinguished. The number of inhabitants is computed at 200,000. The productions, exports, and imports, may be found correctly described in most geographic works. The first discoverers found neither corn nor wine: though, at present, there is plenty of both.

Vessels may pass between the Canaries, and through their principal channels; as there is no known danger but what may be plainly discerned, excepting a sunken rock, laid down in some charts, in the southern part of the channel, between Tenerife and the Grand Canary, about 8 leagues E.S.E. of the south point of Tenerife, and 4 leagues westward of the centre of Canary.

In sailing from Funchal to Tenerife, keep well to the westward, steering S. by W. $\frac{3}{4}$ W. [*early South*,] in order to avoid the Salvages, which are very dangerous in the night.

If prevented from weathering the Salvages or the Piton, (described beneath,) by prevalent westerly and S.W. winds, common in the months of January and February, when a heavy swell may set the ship much to leeward; you may safely bear up and run to leeward of the Great Salvage; only observing that, if the swell be very heavy, you must cautiously avoid three shoal spots, lying to the northward and eastward of that isle. Of these, the northern one is about three-quarters of a mile to the northward [*N.N.W.*] of the isle, the inner one on the N.E., 250 fathoms from it, and the outer, in the same direction, one mile and one-tenth. Two others, with 3 and $3\frac{1}{2}$ fathoms, lie at about half a mile from the eastern shore.

The SALVAGES consist of an island, named *Ilha Grande*, or the *Great Salvage*, a larger isle named the *Great Piton*, and a smaller one, called the *Little Piton*, together with numerous rocks. The *Great Salvage* lies, as already shown in pages 21 and 23, in lat. $30^{\circ} 8'$, and long. $15^{\circ} 55'$ or $15^{\circ} 56'$. It is of very irregular shape, and has a number of rocks about it within the distance of a mile.

The Great Piton lies at the distance of $8\frac{1}{2}$ miles W.S.W. $\frac{3}{4}$ W. [*S.W. by W.*] from *Ilha Grande*. This isle is $2\frac{3}{4}$ miles long, N.E. $\frac{3}{4}$ E. and S.W. $\frac{3}{4}$ W. [*N.E. by N. and S.W. by S.*] and has a hill or peak near its centre. The *Little Piton* lies at a mile from the western side of the former, and is three-quarters of a mile long, nearly in the same direction; both are comparatively narrow. These isles are seated upon, and surrounded by, one dangerous rocky bank, which extends from the western side of the Little Isle half a league to the westward.

It has been said of the Great Piton that, in some respects, it resembles the largest Needle Rock at the West end of the Isle of Wight; and, at a great distance, looks like a sail. Its southern part appears green, its northern part barren. It may be seen 5 or 6 leagues off. The Little Piton, is very flat, and is connected to the south point of the

* ALLEGGRANZA (the northern isle) is synonymous with *joyous*, a name given it by the first conquerors of the islands, Jean de Béthencourt and Gadife de Salle. This was the first point on which they landed. After remaining several days at Graciosa, they conceived the project of taking possession of the neighbouring isle of Lanzarote, where they were welcomed by *Guadarfia*, sovereign of the Guanches, with the same hospitality that Cortez found in the palace of Montezuma. The shepherd king, who had no other riches than his goats, became the victim of coward treachery, like the sovereign of Mexico!—*Humboldt*.

Greater one by a continued ledge of rocks. The whole of the eastern side of the Great Piton is rocky and dangerous.

The Baron Alexander de Humboldt, in his voyage of 1799, which has already been noticed in pages 96, 106, and 133, describes his passage from Corunna to Tenerife. The diffuse style of this accomplished writer prevents our giving an exact quotation, but the particulars following are worthy of notice.

Between Corunna and the 36th degree of latitude, no organic body was seen, excepting sea-swallows and a few dolphins; no sea-weeds, nor molluscas, the oceanic insects which emit the phosphorescent light: but, on the 11th of June, the sea appeared to be covered with *medusæ*.* The vessel was nearly becalmed, but the molluscs were borne towards the S.E. with a rapidity four times that of the current. Their passage lasted nearly three quarters of an hour. But few were then seen, following the crowd at a distance, as if they were tired with their journey. Do these animals come from the bottom of the sea, or do they make distant voyages in shoals? We know that they haunt banks; and if the *Eight Rocks*, to the northward of Madeira, exist, they may have been thence detached, as the ship passed but 28 leagues to the eastward of their assigned position.

In the morning of the 13th of June, in lat. $34^{\circ} 33'$, large masses of molluscas, in motion, were again seen; but of these none yielded light, except at the moment of a slight shock: it is, therefore, inferred that, the sparkling of the water is increased by the agitation of the sea.

Between Madeira and the African coast, light breezes and dead calms prevailed. Here, says M. de Humboldt, we were never wearied of admiring the beauty of the nights; nothing can be compared to the transparency and serenity of an African sky. We were struck with the innumerable quantity of falling stars, which appeared at every instant. The farther progress we made towards the south, the more frequent was this phenomenon, especially near the Canaries. In warm climates, especially under the tropics, the falling stars leave a tail behind them, which remains luminous 12 or 15 seconds; at other times, they seem to burst into sparks, and they are generally lower than those in the north of Europe. We perceive them only in a serene and azure sky: they have, perhaps, never been seen below a cloud.

Lanzarote was made on the 16th of June, with exactness, by chronometer. At two, p.m., the land appeared, like a small cloud, at the edge of the horizon. At five it was seen distinctly, particularly a conic mountain, which towered majestically over the other summits. The current drew us towards the coast more rapidly than we wished. As we advanced, we at first discovered the island Fortaventura, famous for its camels; and, a short time after, saw the islet Lobos, in the channel which separates Fortaventura from Lanzarote. The moon illumined the volcanic summits of the latter, the flanks of which, covered with ashes, reflected a silver light. *Antares* threw out its resplendent rays near the lunar disk, which was but a few degrees above the horizon. The night was beautifully serene and cool. Though at but a little distance from the west of Africa, and on the limit of the torrid zone, the thermometer rose no higher than $64\frac{1}{2}^{\circ}$. The phosphorescence of the ocean seemed to augment the mass of light diffused through the air. After midnight, great black crowds, rising behind the volcano, shrouded, at intervals, the moon, and the beautiful constellation of the scorpion. We beheld lights carried to and fro, on shore, which were probably those of fishermen preparing for their labours.

The whole western part of Lanzarote, of which we had a near view, bears the appearance of a country recently overturned by volcanic eruptions. Every thing is black, parched, and stript of vegetable mould. We distinguished, with our glasses, stratified basalt in thin and steeply sloping strata.

On passing the N.W. coast of Lanzarote, the Captain of the Pizarro mistook a rock of basalt for a castle, which *he saluted*, by hoisting the Spanish flag, and sent a boat with an officer on shore, to enquire if English vessels were cruising in the roads. It was then discovered that the coast was that of the isle *Graciosa*, and that, for several

* The *medusa* is a genus of mollusca; its body is gelatinous, or jelly-like, spherical, and generally flat beneath; mouth central and beneath. There are 44 species. The larger species, when touched, cause a slight tingling and redness, and are usually denominated *sea-nettles*. They are supposed to constitute the chief food of cetaceous fish. Most of them shine with great splendor in the water. M. de Humboldt says that, the *sea-nettle* class is known by its brownish yellow colour, and by its tentacula, or arms, which are longer than the body. Several were four inches in diameter: their reflection almost metallic: their changeable colours, of violet and purple, form an agreeable contrast with the azure tint of the ocean.

leagues, there was not an inhabited place! At sun-set the vessel was again under sail, but the sea was calm, a reddish vapour covered the horizon, and seemed to magnify every object. The black mountains of Graciosa appeared like walls of 500 or 600 feet; and their shadows, thrown over the surface of the ocean, produced a gloomy aspect. Rocks of basalt, emerged from the bosom of the ocean, appeared like ruins of some vast edifice: but the back-ground of the picture, the coasts of Lanzarote, presented a smiling aspect.

The vessel was now attempting to make her passage out between Allegranza and Clara; but the wind having fallen, the current drove her towards a rock, near Clara, on which the sea broke with violence, and which is noted in the old charts, under the name of *Infierno*, or Hell Rock. It is composed of a mass of lava, three or four fathoms high, and covered with scorix, resembling coke. We may presume that this rock was raised by volcanic fire, and may, heretofore, have been much higher. It is now generally called the *West Rock*.

As the fall of the wind, and the strength of the current, prevented a passage through the channel of Allegranza, an attempt was made to tack through between Clara and the West Rock. This proved nearly fatal, for the current set so strongly toward the rock, that the sloop no longer obeyed the helm, and she was expected to strike upon it; but, the wind having freshened a little towards the morning, the vessel, at length succeeded in passing.

Allegranza, Clara, and Graciosa, are now visited only for the orchilla or archil, which is found upon them, and which is valuable for its use in dying. Clara is noted for its beautiful canary-birds, and it yields pasture for goats.

LANZAROTE is very high, and may be discerned at a great distance. On approaching, it appears black, rocky, and barren. It has three good harbours, the principal of which, called PUERTO DE NAOS, is on the south-east side. Any vessel, not drawing more than 18 feet, may enter it at high water, spring-tides, and lie secure from all winds and weather; although, in sailing along the coast, the shipping appears as if at anchor in an open road, the harbour being formed by a ridge of rocks, not perceivable at any distance, as most of them are under water: these break off the swell of the sea, so that the inside is as smooth as a mill-pond. As there is no other convenient place in the Canaries for cleaning or repairing large vessels, it is much frequented for that purpose, by the shipping trading to the islands. At the west end of the harbour stands a square castle, built of stone, and mounted with some cannon, but of no great strength, for ships of war may approach within musket-shot of it. There is no town, but some magazines are erected, where corn is deposited, in order to be ready for exportation.

On the west side of the castle lies another port, called PUERTO DE CAVALLOS, and by some *El Recife*. This is also an excellent harbour, formed, like Puerto de Naos, by a ridge of rocks; but its entrance is shallow, there being no more than 12 feet of water in it, with spring-tides. The castle, before mentioned, is built upon a small island, between the two harbours, and so defends them both: this island is joined to the land by a bridge, under which boats go from one port to the other; or from Puerto de Cavallos to Puerto de Naos.

At the north end of Lanzarote is a large spacious harbour, called EL RIO, which is the strait, or channel, dividing this island from the uninhabited one called *Graciosa*. A ship of any burthen may pass through this strait; for, if she keeps in the mid-way, between the two islands, she will have 6 or 7 fathoms of water all along.

If a smooth place to lie in, while the trade-wind blows, be required, a ship coming into this harbour from the eastward must run a good way in, and double a shallow point, which lies on the starboard hand, taking care to give it a good berth; and this is easily done by approaching no nearer than in 4 fathoms; when past it, edge towards Graciosa, and anchor in any convenient depth; for it shoalens gradually towards the shore, close to which there are 2 fathoms.

This is a commodious place, in the summer-season, for careening large ships; for a man-of-war, of any nation, that happens to be at war with Spain, may come here and unload all her stores, &c. on the Isle of Graciosa, and heel and scrub. Or, if two vessels chance to come in together, the one may heave down by the other; in doing which, they need not fear any opposition from the inhabitants, for there is neither castle nor habitation near this spot.

The water, however, is not so smooth here as at Puerto de Naos, especially if the trade-wind happens to blow hard from the East, which sends in a swell that makes it troublesome, if not impossible, to careen a ship properly. But the wind here does not often blow from that quarter; those winds which mostly prevail being from North and N.N.E. In mooring here, great care must be taken to have a good anchor, with a large scope of cable towards Lanzarote; for, in east and south-east winds, heavy gusts or squalls come from the high-land of that isle. In the winter, the wind sometimes shifts to the S.W.; then it is necessary to weigh, and run back to the eastward, round the shallow point before mentioned, until the ship be sheltered from that wind, and there anchor.*

That part of Lanzarote, facing the harbour or channel of El Rio, is a high steep cliff, from the bottom of which to the shore is about two musket-shots distance. The ground, in the space, is low; and here is a salina, or salt-work. From the shore, there is no way of access into Lanzarote other than by climbing a narrow, steep, and intricate, pathway, that leads to the top of the cliff, which it is scarcely possible for a stranger to ascend without a guide.

The Island of GRACIOSA, already noticed, which lies on the north side of the channel El Rio, is about 3 miles in length, and two in breadth. It is destitute of water. The little Isle of Allegranza lies to the northward of this, at the distance of 6 or 7 miles. About 8 miles to the eastward of Allegranza and Graciosa, is a large high rock, called Roca del Este, or the East Rock; the Roca de Ouest, or West Rock, has been already described, in page 212. Many ships have been wrecked upon these islands in the night, being misled by errors in their reckoning, by the currents, and also by these islands being improperly laid down in some charts, which place them nearly 30 miles farther South than they ought to be.

FORTAVENTURA.—The channel between this island and Lanzarote is called *La Bocayna*; on the south side of its eastern entrance, very near Fortaventura, lies the little island of *Lobos*, or Seal's Isle, which is about one league and a half in circumference, uninhabited, and destitute of water. Near this isle is a good road for shipping; the mark for which is, to bring the east point of Lobos to bear nearly N.E. by N., and anchor half-way between it and Fortaventura, or rather nearest to the latter. Although this road seems to be open and exposed, yet it is very safe with the trade wind, for the water is smooth, and the ground every where clean, being a fine sandy bottom. Directly ashore from the road, on the shore of Fortaventura, is a well of good water, of easy access.

Through the broad channel, *La Bocayna*, ships sail very safely, as it is deep in the middle, and shoalens gradually towards Lanzarote, near to which are 5 fathoms of water; but very near, or close to Lobos, the ground is foul and rocky. In this passage, vessels of any burthen may find room enough to ply to windward, and there is no necessity of approaching too near to Lobos.

When a vessel comes from the eastward, with the trade-wind, and is passing through the Bocayna, to the westward, so soon as she brings a high hill on Lanzarote directly to windward of her, she will be becalmed, and soon have the wind at S.W. Should this happen, make short tacks until you obtain the trade again, or a constant northerly wind, the first puff of which will come from West, or W.N.W. So soon as this is perceived, you must not stand to the northward, otherwise you will immediately lose it again, but must steer towards Lobos; for the nearer you approach this isle, the more will you have the wind: so that, before you are two-thirds over, you will meet with a steady wind at North, or N.N.E.

When there is a great westerly swell hereabout, the sea breaks horribly on the rocks at the N.W. end of Lobos. Captain Glas affirms that, he has seen breakers there nearly 60 feet high; of which, were one to strike the strongest ship, she would be staved to pieces in a moment. "When I first saw," says Captain Glas, "those mighty breakers, our ship had just passed through the channel, between Fortaventura and Lobos; we had a fine brisk trade-wind at N.N.E.; and, although there were no less than 10 fathoms of water, when we came into the westerly swell, yet we trembled lest the waves should

* Particular plans of this Strait, and of the Harbours of Naos and Cavallos, are given in our Chart of the Azores, &c.

have broken, and thought ourselves happy when we got out of soundings. We heard the noise of these breakers, like distant thunder, after we were past them 6 or 7 leagues."

CANARIA, or GRAND CANARY.—The Isleta, or N.E. point of this island, lies 16 leagues N.W. by W. $\frac{1}{4}$ W. [*W. by N.*] from Point Handia, the S.W. end of Fortaventura; and, in clear weather, either of these islands may be seen from the other. The centre of Canaria is exceedingly high, and full of lofty mountains, which tower so far above the clouds, as to stop the current of the north-east wind that generally prevails here; so that, when this wind blows hard on the north side of the mountains, it is either quite calm on the other side, or a gentle breeze blows upon it from the S.W.* This island is the granary of the Canarian Archipelago, and has, in some districts, two wheat-harvests in the year; one in February; the other in June.

On the north-east end of Canaria is the peninsula called the Isleta, 2 or 3 leagues in circumference; the isthmus, by which it is connected with the main island, is about 2 miles long, and a quarter of a mile broad at the narrowest part. On each side of this isthmus is a bay, which, being exposed on the N.W. side to the swell of the sea, is, therefore, an unfit road for shipping; but small barks get in between a ledge of rocks and the shore, and lie there smooth and secure from all winds and weather. Here the natives repair their small vessels.

On the other side of the isthmus is a spacious sandy bay, called by some, *Puerto de Luz*, and by others, *Puerto de las Isletas*, from some steep rocks, or islets, at the entrance of the bay, towards the N.E. This is a good road for shipping of any burthen, with all winds, except from S.E., to which it is exposed; but that wind, which is not common here, seldom blows so hard as to endanger a ship.

The landing-place is in the very bight or bottom of the bay, where the water is generally so smooth, that a boat may lie broadside to the shore without danger. Thence, along shore, about a league to the southward, is the city of PALMAS, the capital of the island. Shipping, that discharge their cargoes at Palmas, generally anchor, in good weather, within half a mile of the town, for the quicker dispatch; but that place is not a good road.

The next port of any consequence in Canaria is *Gando*, situated in the middle of the east side of the island. It is a good place for shipping with all winds, except from the southward; and there good water, with other refreshments, may be had.

TENERIFE, or TENERIFFE.—Point Naga, the N.E. end of Tenerife, bears N.W. $\frac{3}{4}$ N. [*N.W. by W.*] $15\frac{1}{2}$ leagues from the north-east point of Canaria; but, from the western part of Canaria to the nearest part of Tenerife, the distance is 10 leagues. In the centre of the island is the famous peak, called, by the antient and present inhabitants, the *Peak of Teyde*.

On coming towards the island, in clear weather, this peak may be clearly discerned at a great distance;† it first appears like a thin blue vapour, or smoke, very little darker than the sky; at a farther distance, the shade disappears, and is not distinguishable from the azure of the firmament. Before you lose sight of this towering mountain, it seems

seems

* A description of these calms is subjoined to the present section.

† They say, in the Canaries, that the Peak, in very clear weather, is seen from La Bocayna, or the channel, between the Isles of Lanzarote and Fortaventura, at the distance of about 50 leagues. The height of the Peak, above the level of the sea, was measured, in 1742, by the engineer, *Don Manuel Hernandez*, who gave his result as 2658 $\frac{1}{2}$ French toises. Doctor *Heberden* told Capt. *Cook*, that he found only 15,000 English feet, or 2346 toises. Father *Feuillée*, in the beginning of last century, having observed, on the top of the Peak, that the mercury sank to 10 inches, 7 lines; M. *Cassini* concluded, that the height of that mountain must be 2624 toises: but the trigonometrical operations of the same Father *Feuillée* gave that height at 2213 toises: which, from some defects in the operations, are reduced by M. *Bouguer*, to 2099 toises. This height being known, the distance is easily found from which the Peak can be perceived.

Mr. *Dalrymple* has said, that, with due deference to these celebrated measurers, I have had an opportunity of confirming Capt. Glas's opinion, having seen this peak at noon; when, by a good observation, the ship was 3 degrees to the southward of it; not appearing dimly, but evidently to the whole ship's company.

M. de Humboldt has since given, as his opinion, that, probably, the real height of the Peak differs little from the mean between three geometrical and barometrical measurements of Messrs. Borda, Lamanon, and Cordier, namely 1905, 1902, and 1920 toises, the mean of which is 1909 toises, or 2033 English fathoms.

seems at a considerable height above the horizon, although, by its distance, and the spherical figure of the earth, all the rest of the island, the upper part of which is exceedingly high, is sunk beneath the horizon. But, in general, in sailing towards Tenerife, when the trade-wind blows, the island appears as a haziness of the sky, or as a cloud, till within the distance of 5 or 6 leagues, and then the headlands shew like land, and are first conspicuous.

TENERIFE presents to the curious eye the most singular object, perhaps, in the northern hemisphere. The island appears, on sailing along the coast, from north to south, to have once been a complete cinder; and presents to view a great deal of the brokenness and irregularity of a half-consumed coke. This resemblance, however, contrary to expectation, becomes less perfect as we approach the peak, the great chimney of the fiery cauldrons boiling beneath. The whole island within is any thing but picturesque. The mountain or peak is still an active volcano, whose only crater is said to be at the summit; an elevation incomparably above that of any other part of the island or neighbouring shores.

At a short distance from Point Naga, the N.E. point of Tenerife, are some high perpendicular rocks; and 4 or 5 leagues thence, on the east side of the island, is the bay, or roadstead, of SANTA CRUZ, the most frequented of any in the Canaries. The best road for shipping here is, between the middle of the town and a fort, or castle, about a mile to the northward of it. In all that space, ships anchor, from a cable's length distance from the shore, in 6, 7, and 8, fathoms of water, to half a mile, in 25 or 30 fathoms. Particular care must be taken, in going in, not to bring any part of the town to the northward of West, lest calms should be occasioned by the high land under the Peak; otherwise you will be in danger of driving upon the shore; and, when ashore, will have no ground on the opposite side of the ship, with 200 fathoms of line, so that anchors and cables are of no use.

When a ship lies any time in the road, it is necessary to buoy her cables, otherwise the ground, being in some places foul, may chafe and spoil them. Here vessels, if moored with good cables and anchors, may lie securely in all winds, although the bay is exposed and open to those which blow from the N.E., East, and S.E.; however, it is not above once in the space of four or five years that they blow so hard as to cause any considerable damage. The surf frequently beats on shore, with great violence, for several days together; and the pier is ill-contrived for shelter.

Captain Vancouver anchored here, in 1791, and, in the relation of his voyage, has stated, "We had the mortification, this morning, (May 1st,) of finding the small bower cable cut through nearly in the middle, which seemed to have been occasioned by an anchor lying at the bottom. The loss of an anchor, where no other could be procured, was a matter of serious concern; no pains were spared to regain it until the afternoon of the 5th, when, all our exertions proved ineffectual; and, being apprehensive that other lost anchors might be in the vicinity, we weighed, went farther out, and again anchored, in 30 fathoms, on a soft, dark, oozy, bottom, intermixed with small white shells, having the northernmost church-steeple in a line with the centre of the jetty, bearing, (by compass,) N. 48° W., and the southernmost fort S. 71° W., about three-quarters of a mile from the town. This anchorage appeared to be so far preferable to our former situation, being nearly as convenient to the landing-place, without the hazard of damaging the cables by anchors which small vessels might have lost nearer in-shore; and which is the only danger to be apprehended here, as the bottom is good holding-ground, and, to all appearance, perfectly free from rocks."

Don Cosme de Churruca having assumed the height of the peak at 2193 Spanish toises, or 1994 English fathoms, computes the distance at which it may be seen, according to its angular altitudes, as follow: Elevated one degree, nearly 79½ miles; 2½ degrees, 45½ miles; 4 degrees, 31 miles; 5½°, 23 miles; 7°, nearly 18½ miles; 8°, 16 miles; 9°, 14½ miles.

We have noticed, in our Memoir on the Northern Ocean, page 50, two remarkable instances of mutable refraction in the atmosphere. To these many others might be added; and, as the apparent altitude of the mountain certainly varies with the changes in the atmosphere, we may admit that it has been seen at distances considerably greater than those computed from the assumed height.

M. de Humboldt says, "It may be admitted, in general, that the Peak of Tenerife is seldom seen at a great distance in the warm and dry months of July and August; and that, on the contrary, it is seen at very extraordinary distances in the months of January and February, when the sky is slightly covered, and immediately after a heavy rain, or a few hours before it falls.

Captain Vancouver has observed, that, when he was here, he found the wine, water, and beef, exceedingly good, and was therefore induced to take some days' supply of the latter to sea; but fruit, vegetables, poultry, and all kinds of live-stock, were very indifferent, and most extravagantly expensive.

The water is easily procured when the surf is not great on the beach. A good supply of wine may, also, be readily had.

The aspect of Santa Cruz is gloomy, and the heat is commonly excessive. On a narrow and sandy beach, houses of dazzling whiteness, with flat roofs, and windows without glass, are stuck against a wall of black perpendicular rocks, stripped of vegetation. A fine mole, built of free-stone, and the public walk, planted with poplars, are the only objects which break the sameness of the landscape.

The following extracts, from the relation of the voyage of Commodore Krusenstern around the world, will afford a good idea of the condition of the Canary Islands, in October, 1803.

Of Santa Cruz, this excellent officer says, the characteristics are, the general misery of the people, the gross depravity of the female sex, and the swarms of fat monks, who stroll about the streets so soon as it is dark. These objects excite, in the mind of a stranger, the sensations of pity and disgust. There is no place in the world where so many horrid objects are to be seen. Beggars of both sexes and all ages, clad in rags, and afflicted with every kind of disgusting complaint, fill the streets, together with lewd women, drunken sailors, and lean and deformed thieves. He adds, "I am almost tempted to believe that the lower classes of inhabitants here have all an equal propensity to stealing. A person might fancy himself transported to one of the islands of the South Seas; for he is robbed in spite of the greatest attention and precaution. Whenever a boat came alongside the ship, some theft was infallibly committed in the presence of the whole crew, and I was at last obliged to prevent any one from coming on board. An idea may be formed of the liberty of the citizen here, by the circumstance that no man dare go into the roadstead, even to pay a visit, without the permission of the governor.

"The season was already considerably advanced; but we found an abundance of grapes, peaches, citrons, oranges, melons, onions, and potatoes; every thing was, however, extremely dear. Even the price of wine had risen very much within a few years; for I paid ninety piastres the pipe for what used to be but sixty. This wine is very good, and improves on a long voyage, although it is by no means equal to Madeira. As the inferior kind of wine was but fifteen piastres cheaper than the best, I bought only the latter for the use of the men. The brandy which is made here is very bad, and is used only in Spanish America, as it would not be drank in Europe. Beef was dear, and cost eight-pence sterling the pound; for a very moderate sheep we paid seven piastres, and for a fowl one. To all these prices must be added at least twenty per cent. commission. Every cask of water cost us one piastre.

"Upon the arrival of the Russian frigates towards the Road of Santa Cruz, Don Carlos Adam, Lieutenant of the Spanish Navy and Captain of the Port, came immediately on board, and recommended us to keep to the eastward of the road, as the best place of anchorage, where we brought-to in 36 fathoms. The ground is not so rocky here as it is in other parts of the road, nor are there so many lost anchors in the ground, which is frequently the occasion of the loss of others."

From this cause, the Neva, which lay more to the S.W., lost a sheet-anchor and two cables, while the Nadezhda's cables did not suffer in the least. It is, however, necessary to take the precaution of buoying them up with casks to keep them floating: I would recommend this situation in preference, notwithstanding the great depth of water, and will therefore give the exact situation of the ship after we had let go our other anchor to the N.E. in 24 fathoms of water. The N.E. point of the road bore N. 69° E.; the S.W. point, S. 36° W.; and the church of St. Francis, which is distinguished by a very high tower, S. 51½° W. There is, indeed, this disadvantage attending the situation, that should a storm spring up at S.W., and the ship not like to ride it out in the road, it would be very difficult for her to beat out. Violent storms, however, are not common, even in winter; and, if the anchor and cable can be depended upon, it is better to remain in the road. The Spaniards, and they alone, moor with four anchors; two to the N.E. and two to the S.W., in compliance with an antient law.

The mean of the several observations, which were taken in the road, made the latitude of our anchorage to be $28^{\circ} 27' 33''$; and the longitude, by Arnold's large watch, No. 128, $16^{\circ} 12' 45''$. The true longitude, as settled by the Chev. de Borda and M. Varela, is $16^{\circ} 15' 50''$.*

OROTAVA, &c.—The next best port to that of Santa Cruz is the port of *Orotava*, on the western side of the island, and which lies about $8\frac{1}{2}$ leagues to the south-westward of Point Naga. It is a good harbour in the summer-season, or from the beginning of May to the end of October; but, in winter, ships are often obliged to slip their cables, and put to sea, lest they should be surprised by a N.W. wind, which throws in a heavy sea: luckily these winds rarely happen; and, in general, give warning, so that a vessel has time to get away. Straggling rocks project about 2 ships' length from shore, on which the sea breaks furiously. It is commonly calm in the road, but there is almost always a long northerly swell, that causes ships to roll very much.

The anchorage is in 50 fathoms, about a mile and a half from shore, with the peak bearing S.W.; and it is proper to continue a pilot on board whilst lying here.

Orotava stands upon a gentle slope at the foot of the mountain, and is surrounded by fields of corn, gardens, and vineyards. The culture of the soil is here promoted to a very extraordinary degree, particularly in some patches so elevated and so secluded as to appear inaccessible to the husbandman. But the plain is very forbidding; and the beach composed of naked, pointed, and cinerous or scorched rocks.

ADVICES from TENERIFE, dated the 11th of November, 1816, stated the great embarrassments foreign ships have to encounter on their arrival at that island, from want of a knowledge of the regulations to be observed. Almost all the British vessels, and particularly the East-India ships, which have had occasion to touch at the island for refreshments, have been subject to a heavy expense, and much vexatious delay, by the want of bills of health, and by other omissions. To prevent inconvenience, it is necessary to observe the directions for British vessels frequenting the island of Tenerife. The directions are as follow:—

“A bill of health is an indispensable document for a vessel's admission here, from whatever port she may arrive. The quarantine-laws are very rigorously enforced, and the want of a bill of health subjects vessels, even from England direct, to a quarantine, that is never removed without the ceremony of repeated health-visits, and payment of heavy fees. Great care must be taken not to get to leeward of the island, as it is a tedious and difficult matter to get up again, the usual and prevalent winds being between N.N.E. and E.N.E. Point Naga should be made, which is the N.E. point of the island, and is very high, and is easily to be known by two large high rocks lying close to it, which appear like ships, and may be seen seven or eight leagues off. You must then run down till you come within two or three leagues; and if bound to Port Orotava, you must steer down along the north shore, (which is very bold, and quite free from danger,)

* **REMARKS of CAPTAIN LISIANKY**, of the *Neda*.—“The bay of Santa Cruz is not a safe anchoring-place, especially in winter; from its being open to the S.E., a quarter from which the wind sometimes blows with great violence. To this may be added, that it has, in many places, a rocky bottom, and abounds so much with lost anchors and warps, that it is necessary to buoy up the cables to prevent their chafing: we found three small casks to each of our cables to be sufficient for the purpose. We were moored S.S.E. and N.N.W., having Port Christoval N. $81\frac{1}{2}^{\circ}$ W., South-Fort S. $55\frac{1}{2}^{\circ}$ W., and St. Raphael N. 5° E.; and the only damage we sustained was the loss of a warp, which we could not heave up when we unmoored.

“To come into the bay, you must sail close in-shore, after passing around the N.E. part of the island; and you should endeavour to get bottom as soon as possible: for which purpose a heavy lead with fifty fathoms of line should be in readiness. The shore here is very high, and so deceiving, that, when I thought myself four leagues from it, I afterwards found, by my run, that I had been mistaken by nearly half that distance.

“During our stay here, the peak was so constantly overclouded, that we could see it distinctly only twice. The summit was then (in October) covered with snow, but this is not the case, we were informed, in the months of June and July. The latitude of our anchoring-place, according to the different meridian altitudes, appeared to be $28^{\circ} 26' 36''$ N.”

In 1820 or 1821 H. M. Ship *Tartar* anchored in the Road of Santa Cruz, in 26 fathoms, dark sand and mud, with the S.W. point of Santa Cruz, S.W. $\frac{1}{2}$ W., the church in the middle of the town W. by N. $\frac{1}{4}$ N., and the easternmost battery N. by E. $\frac{1}{2}$ E.—At a mile and a half without the ship, no bottom at 150 fathoms. Stock of all kinds was then plentiful; the bullocks large, weighing from four to seven hundred weight. Ships in want of water can always be supplied, on moderate terms, by the boats belonging to the place.

keeping two or three leagues distance; and, after running down eight or nine leagues, if you should not see the Peak, which is often clouded, you will see a large white town (Orotava) on the side of the high land, about a league inland, with two small regular-shaped green hills under it, between which you must steer directly in, and, by doing so, will raise, as it were, another town out of the sea; this is Port-Orotava, for which you must steer directly in, until you meet the pratique-boat, which will be about two or three miles off: it is a low boat, and comes with the Spanish colours set upon a staff: at any rate, you must not be afraid of running in for the land, as it is very deceiving, and you will be four or five leagues off when you do not think yourself so many miles; and in that case you will not soon get a boat, for they do not come off until you approach very near. The boat, when she comes, brings a pilot, and leaves him on board: you must also bring with you your register, pass, clearances, &c.; and you must take care not to deliver either letters or other papers (except your bill of health) to any person who may ask for them, without some document, either from your consignee or the consul.

"In running down, you must prepare your anchors and cables, and it is customary to bend your small bower-cable, with which you will bring up with only one turn round the windlass, in order that it may run out quick, as the spot where you ride (about half a league off, and to the westward of the town) is very small; and if there be many vessels there, it is necessary that your anchor go very quick, as you bring up in from 30 to 40 fathoms of water; but there is little or no tide, and she will bring up easily. You must give her the whole cable round the windlass; your buoy-ropes should, therefore, be 45 fathoms long. During the summer months, from April to October, all vessels are moored in an inner harbour, or creek, with iron chains, kept by the merchants for that purpose. Vessels that fall to leeward very often lose much time by mistaking Garachico for Port Orotava, from whence it is distant four and a half leagues west. There is some similarity in the appearance of these places, Garachico having also above it a white town, inland, called Icod; but besides, by their situation, Garachico being much nearer Point Teno, the west point of the island, these places are very easily distinguished by the above-mentioned two equally formed round green hills. Point Naga lies in $28^{\circ} 36'$, and the Salvages lie *true* North from the point, distant about 28 leagues.

"The Grand Salvage is very high, and may be seen ten or twelve leagues off. Your direct course from the Grand Salvage to Port Orotava is S.W. (by compass) and distance 38 leagues; but particular care must be taken not to fall to leeward. The Peak of Tenerife may sometimes be seen forty leagues off, but it is very often hidden by clouds. Should it happen in the winter that you arrive off Port Orotava, during a N.W. or N.N.W. gale, which rarely occurs, but throws in a very heavy sea upon the coast, and would prevent a boat going off to you, it is best to bear away for Santa Cruz, on the S.E. side of the island, after doubling Point Naga.

"Santa Cruz is the preferable place to touch at, for vessels in want of water and refreshments. All vessels, on approaching these ports, ought to hoist their colours, and shew their consignee's signal; or, when unconsigned, and only visiting the island, a Union Jack at the fore, and a white flag with a pennant over it at the main, in order that boats may be early sent off to them by their consignees, or by the consul."

PALMA.—From the western end of Tenerife to the nearest part of the Island of Palma, the distance is about 15 leagues. The summit of this island is higher than the general level of Tenerife, its peak excepted; hence some navigators run towards it with great confidence in the night.

The chief port is that of Santa Cruz, on the east side of the island. The mark by which a stranger may find it is the following:—When he approaches the east side of the island, Palma will appear shaped exactly like a saddle. Let him steer so as to fall in a little to windward of the lowest place, or middle of the saddle, till he comes within a mile of the land; then, running along shore to the southward, he will perceive the town close by the sea-shore, and the shipping lying in the road; but, as the land behind the town is high and steep, one cannot discern the shipping till within a mile of them. The road is within a musket-shot of the shore, where vessels commonly ride in 15 or 20 fathoms of water, and are exposed to easterly winds; yet, with good anchors and cables, they may remain with great safety in all winds; for the ground is clean and good, and the great elevation of the island, with the perpendicular height of the land facing the road, repels the wind that blows upon it, though ever so strong.

When there is a great north-east swell out at sea, it comes rolling into the bay, but the want of wind, and the deepness of the water, deprive it of strength or power; so that ships, in such a case, ride here with a slack cable. These circumstances render the road of Santa Cruz, in Palma, more secure than any of those of Canaria or Tenerife; but, in the winter, the rolling swell, which comes into the bay, breaks high upon the beach, and prevents boats from going off, or landing, for the space of three or four days together.

Santa Cruz de la Palma is a large town, but not so good and large as that of Palmas, in Canary, or of the towns of Tenerife. Near the mole is a castle, or battery, mounted with a few cannon, for the defence of the shipping, &c. In the middle of the town, near the great church, is a fountain, filled by a rivulet, which plentifully supplies the inhabitants with good water.

Tassacorta, the port next in consideration to that of Santa Cruz, is on the S.W. part of the island; it is exposed to westerly winds, and little frequented by any vessels excepting boats.

In all the island there is no town of any note, excepting Santa Cruz; but many villages, the chief of which are St. Andrea and Tassacorta. In the north-eastern part, inland, is a remarkable high mountain, called *La Caldera*, or the Cauldron, being hollow, like the Peak of Tenerife.

GOMERA.—The middle of Gomera lies W.S.W., about 5 leagues from Point Teno, of Tenerife. *St. Sebastian*, the principal town, is situated close by the sea-shore, in the bottom of a bay, on the eastern side, where shipping lie land-locked from all winds, except the S.E. Here you may anchor at a convenient distance from the shore, in from 15 to 7 fathoms; but, as the land-wind frequently blows hard, it is necessary for a ship to moor with a large scope of cable, otherwise she will be in danger of being blown out of the bay. The sea here is generally so smooth, that boats may land on the beach without danger. On the north side of the bay is a cove, where ships of any burthen may haul close to the shore, which is a high perpendicular cliff, and there heave down, clean, or repair. When boats cannot land on the beach, on account of the surf, they put ashore on this cove, from whence there is a pathway along the cliff to the town.

The town has plenty of good water, which is drawn from wells in every part of it; and, in the winter, a large rivulet from the mountains empties itself into the port. On the south side of the mouth of this rivulet stands an old round tower; and on the top of its perpendicular cliff, on the north side of the cove, is a chapel, and a battery, with a few pieces of cannon for the defence of the port.

To the best of my remembrance, says Capt. Glas, the land that forms the north point of the bay is the most southerly point of land, on the east side of Gomera, that can be seen from Point Teno, on Tenerife. That land, when one is to the northward of it, at about a league distant, bears a great resemblance to Rame-head, near Plymouth Sound. In going into the bay, it is necessary to stand close in with this point, for the land-wind is commonly too scanty for a ship to fetch the proper anchoring-place; from that reason it is better to come in with the sea-breeze, which generally begins to blow here about noon.

The best place for a ship to lie in here is, where a full view may be had along through the main street of the town, and at about the distance of a cable's length from the beach: it is necessary to moor as soon as possible, because of eddy winds that sometimes blow in the bay.

FERRO.—This island, the westernmost of the Canaries, has neither road or harbour worthy of particular description. It has one church, but the town is inconsiderable. The land rises steeply from the sea, and is craggy on all sides for about a league, so as to render the ascent very difficult. It produces, however, many trees and shrubs, with better grass, herbage, and flowers, than any of the other islands, so that bees and honey abound. The wine is poor, and there are only three fountains or springs of water on the island.

DIRECTIONS for SAILING among the CANARY ISLANDS, by CAPT. GLAS.

If a ship, lying at Palma, wants to go to Lanzarote, and will not wait for a fair wind, (which, indeed, seldom blows there, especially in the summer-season,) let her stand over to the N.W. side of Tenerife, and beat up along shore until she weathers Point Naga; thence

thence, with the wind that generally prevails in these parts, she will be able to weather Canaria, and fetch the Point of Handia, or Fortaventura, or perhaps Morro Gable, (the southern point,) whence it is easy to beat up to Pozzonegro, along the east side of the island, because the sea there is always smooth. It is not quite so easy to beat up from Pozzonegro to the Isle of Lobos; yet it may be done, without difficulty, when the weather is moderate: if the wind should happen to blow hard, she may stop in the Bay of Las Playas, until it proves more favourable.

From the Isle of Lobos she will find no difficulty in beating up to Porto de Naos, in Lanzarote. It is not advisable for those who are not perfectly well acquainted with that harbour, to attempt to conduct a ship in, because the entrances are very narrow.

It is common for ships, which come loaded from Europe to Santa Cruz, Tenerife, &c., to have part of their cargoes to unload at Port Orotava: these ships, when the trade-wind blows hard, will sometimes find it impracticable to weather Point Naga: when this is the case, bear away to the leeward point of the island, and keep near the shore, where, if you do not meet with a southerly wind, you will be carried by the current, in the space of 24 hours, from the S.W. point of the island to Point Teno, whence you may easily beat up to Port Orotava; for, when the wind blows excessively strong at Point Naga, it is moderate weather all the way from Point Teno until within 2 or 3 leagues of Point Naga. But I would not advise a ship to bear away as above directed, unless when the trade-wind blows so fresh that she cannot weather Point Naga: because, in moderate weather, there is little or no wind stirring on the coast between Teno and Port Orotava.

THE COAST of AFRICA, east of the Canaries, is level, and is rendered inaccessible by a heavy surf, which breaks on it continually. The Canarians, in the sea between this coast and the islands, employ a number of barks to fish for bream and cod.

Of the CALMS of the CANARY ISLANDS. (By the same.)

It has been already noticed, in the description of the Island of Canaria, "That its mountains tower so far above the clouds, as to stop the current of the north-east wind that generally blows here; so that, when this wind blows hard on the north side of the mountains, it is either quite calm on the other side, or a gentle breeze blows upon it from the S.W." These calms and eddy-winds, occasioned by the height of the mountains above the atmosphere, extend 20 or 25 leagues beyond them to the S.W. There are calms beyond, or to leeward of, some of the rest of the islands, as well as Canaria; for those of Tenerife extend 15 leagues over the ocean, the calms of Gomera 10, and those of Palma 30. "I have," says Captain Glas, "been frequently in all the calms of the islands, excepting those of Palma; and, from my experience of them, I may venture to say, that it is extremely dangerous for small vessels, or open boats, to venture within them when the wind blows hard without. It is true, indeed, the wind raises the waves of the sea to a mountainous height: yet those waves follow each other in regular succession; for, were they to fall confusedly one against another, no ship would be able to sail on the ocean. But, in a storm, the wind driving the sea before it, each wave gives place to the one which follows; whereas, in the calms in the Canary Islands, the sea not moving forward in the same direction with the sea without, but being as it were stagnant, or at rest, resists the waves that fall in upon it from without; and this resistance causes them to break just in the same manner as the billows break upon the sea-shore, but with less violence, on account of the different nature of the resistance. This breaking of the waves is only on the verge of, or just entering into, the calms; for within them the water is smooth and pleasant.

Upon first coming into the calms, the waves may be seen foaming and boiling like a pot, and breaking in all directions. When a vessel comes amongst them, she is shaken and beaten by the waves on all sides, in such a manner, that one would imagine that she could not withstand their force; however, this confusion does not last long. The best way to manage a ship entering the calm is, immediately to haul up the courses, and diligently attend the braces, to catch every puff of wind that offers, in order to impel the ship into them as soon as possible. The crew must not think it strange to be obliged to brace about the yards every two or three minutes, according as the wind veers and hauls;

hauls; but, after a ship is once fairly into the calms, she will either find a dead calm and smooth water, or a pleasant and constant breeze at South or S.W., according as the wind blows without, to which this eddy-wind, as it may be called, always blows in an opposite direction.

REMARKS MADE ON SAILING FROM THE CANARY ISLANDS TO THE EQUATOR, *by Captain Lisiansky, of the Russian Navy, in 1803, and on recrossing the Line, &c. on the homeward Route, in 1806.*

"Amongst the many different things deserving the attention of navigators, the sea-currents are not the least important. I am, indeed, firmly persuaded that attention to this subject may lead to useful discoveries; and accordingly made it a rule to keep a journal of the daily difference between the ship's course by reckoning and observation.

"From the Canary Islands to the latitude of 6° N., where the variable winds took place, the motion of the sea was towards the S.W. quarter: it then took a N.E. direction as far as $1^{\circ} 34'$ N., when we received the S.E. trade; and then again to the westward, in which it continued until we passed the equator. On calculating the variation of the current from all the above-mentioned tendencies of the sea, it appears that the *Neva*, in her run from Tenerife to the line, was driven by it about 60 miles to the southward, and nearly the same distance to the westward.

"After having passed the equator, (longitude $24^{\circ} 9'$ W.) the S.E. trade freshened by degrees; and, as we proceeded, veered a little to the east, which was favourable to our course."

On recrossing the equator, 11th of May, 1806, (longitude $16^{\circ} 48'$ W.) "we had a pretty strong westerly current; but it soon changed to the S.E., and so continued until we reached 9° N. It then took a direction to the S.W., and occasionally to the N.W., pushing us on as far as the tropic, at the rate of 15 miles a day. From the tropic till we had variable winds, it was constantly to the S.W., when it returned again to the S.E., and kept to that point till we made the Western Islands, where we found that, from the line, we had been borne by currents, altogether, 30 miles to the South, and 3 degrees to the West.

"Between the parallels of 21° and $36\frac{1}{2}^{\circ}$ N. we passed continually a quantity of seaweeds, which appeared like large floating islands. These weeds were full of small fish and crabs, of which we caught a great number, chiefly from curiosity."

G. THE SARGASSO SEA.

A vast portion of the sea, to the true N.N.W. and N.W. of the Cape Verde Islands, between the parallels of about 18° and 36° of latitude, is commonly studded over, like an inundated meadow, with bushes of a marine plant, called the *fucus natans*, and more commonly *Gulf-weed*: this is, in some places, very abundant, and in others more dispersed. Hence has this part of the ocean been denominated the *MAR DO SARGASSO*, or the *SARGASSO SEA*. "If we could imagine the surface of a wide extended moor, covered with water, the furze and heath-bushes would appear something like the clusters of *fucus* scattered over the thickest part of this sea."

The Sea of Sargasso may be considered as an eddy, situated, in point of latitude, between the regular equinoctial current, setting to the westward, and those easterly currents put in motion by the westerly winds, commencing a little to the northward of the parallel in which the trade-winds begin to blow.

On the weed which is found within this part of the Atlantic, we have the following remarks, by *Captain Livingston*, whose name has so frequently occurred in the preceding pages.

"Many persons suppose that the *Gulf-weed* (*fucus natans*) grows upon the rocks about the Bermudas, others that it originates among the Florida Reefs, and a third party that it grows upon the water, without ever adhering to any thing fixed.

"All these positions seem to me equally wide of truth. Neither on the Bermuda Rocks, nor among the Florida Reefs, has a single branch of Gulf-weed ever been found growing upon the rocks: and, among all the Gulf-weed met on the ocean, no person has ever found a single tuft with roots, or that, on mature examination, could be supposed, by any person of sound judgment, to have grown on the surface of the water. On the contrary, every stalk of the weed seems to have been broken off short from something to which it firmly grew, and *all the ends* of these stalks are uniformly decayed, or dried up, from the end to a short distance.

"I am *not* of opinion that the weed which Captain Bourke, of the Archibald, met with, about the parallel of 20° to the eastward of Porto-Rico,* was carried there by an offset from the Florida Stream, as at first supposed; although I believe that such an offset *occasionally* exists. I am of opinion that the Gulf-weed grows in the centre of the immense eddy or whirlpool, formed by the inclination of the water to the westward, caused by the influence of the trade-winds, between the latitudes of about 6° and 22° North, and the Gulf-stream, &c. between the parallels of 22° and 34° ; that it *grows on the rocks, at the bottom of the ocean*, in the Sargasso or Grassy Sea, in the space comprehended between the 22d and 34th parallels of latitude, and the 26th and 58th or 60th meridians of longitude, West of Greenwich; that, the stalks decaying, or being broken off by some agitation of the sea near the roots, the tops rise to the surface of the water; and, finally, that, in place of being spread over the surface of the ocean by the Gulf-stream, this stream is the very cause of retaining the weeds within the bounds wherein it is usually met: and I hold, that the *few* sprigs of weed which are seen in the Gulf-stream, are either *carried* there by an influence of the winds, or by those *temporary* currents which at times prevail over all extensive oceans. It is well known that many ships have experienced very strong but partial sets of current in many parts of the Atlantic Ocean, which prevail at times only; and, in fact, may well be supposed to originate in causes which have little chance of being satisfactorily explained.†—1st Feb. 1819.—A.L.

"Since expressing the preceding opinions relative to the Gulf-weed, they seem confirmed by circumstances in every day's run we have made to the westward; every succeeding day showing the weed in a state of greater decay. Lat. $24^{\circ} 48'$ N. Long. about 68° , 10th February, 1819.—A.L.

"It has been stated, as a well-known fact, that the *fucus natans* grows on the rocks along the Gulf of Paria, and on the coasts of Caraccas, &c. If this be the case, it is rather strange that it should not grow on other rocks and coasts of the West-Indies. It has also been stated that, in the whole sea of floating-bushes, *Mar do Sargasso*, not a withered plant is ever discovered. This is not true, as I have seen abundance of the *fucus natans* in a state of great decay. I note the following from my journal of the Brilliant, from Gibraltar towards Havana; 8th Feb. 1819, 'the weed much decayed:' 9, 'weed passed through, a.m. much decayed:' 10th, p.m. 'passed through much decayed weed; I remark, that the farther we run to the westward, the more decayed is the Gulf-weed:' 13th, 'the Gulf-weed begins to look fresher.'‡

"These particulars have been given, in order to show that I have not spoken at random, but, on the contrary, actually made my remarks on the spot. Some of the weed was quite brown, and in small fragments; evidently separated into such by its state of decay. It is true that the weed soon decays when it is taken out of the water, as I have often tried the experiment. The weed is never of a verdant green colour, but seems as if blanched from having been, in some degree, hid from light: I suppose from vegetating under water."

Let us now read what M. de Humboldt says upon the same subject.

* See the note (+) on page 115.

† M. de Humboldt has noticed, that the year 1803 will be for a long time memorable in the annals of navigation, because several vessels bound from Cadiz to the Caraccas were forced to lie to, in the 14th degree of latitude and the 46th of longitude, on account of a very violent wind, which blew for several days from the N.N.W. He adds, "What extraordinary interruption must we suppose in the play of the aerial currents to explain such a cross wind." Such anomalies as these serve, in some measure, to account for partial and contrary streams of water on the ocean.

‡ The ship's place may be seen, on the days here mentioned, in a Table included in the Appendix, hereafter. On the 9th of February, the ship passed the meridian of Porto-Rico, and was hence proceeding towards Providence Channel, Bahama.—Ed.

From the depth of about 30 fathoms, in the channel, between Clara and Allegranza, to the northward of Lanzarote, a curious species of sea-weed was brought up from the bottom of the sea: the stem of a brownish colour, and three inches long; had circular leaves, of a tender green, with lobes, and indented at the edge. The vine-leaved fucus, he adds, presents a phenomenon of great interest: fixed to a piece of madrepora, this sea-weed vegetates, at the bottom of the ocean, at the depth of 192 feet, notwithstanding which its leaves are as green as our grasses.

"Mr. Turner, who has so well made known the family of the sea-weeds, and many other celebrated botanists, think that the greater part of the *fuci* (weeds) which we gather on the surface of the ocean, and which, from the 23d to the 35th degree of latitude, and 30th of longitude, appear to the mariner like a vast inundated meadow, grow primitively at the bottom of the ocean, and float only in their ripened state, when they are torn off by the motion of the waves."

"To the north of the Cape Verde Islands we met with great masses of floating sea-weeds. They were the tropic grape, *fucus natans*, which grows on submarine rocks, between the equator and latitude 40°, both north and south. I am assured, from the comparison of a great number of journals, that, in the basin of the Atlantic Ocean, there exist two banks of weeds, very different from each other. The most extensive is a little to the west of the meridian of Fayal, one of the Azores, between lat. 25° and lat. 36°. The temperature of the ocean, in these latitudes, is from 61 to 68°; and the north winds, which sometimes reign there very tempestuously, drive floating isles of weed even to the parallels of 24 and 20 degrees. The vessels which return to Europe, either from the Rio Plata or the Cape of Good Hope, cross these banks, which the Spanish pilots consider as at an equal distance from the Antillas and Canaries. The second bank of fuci (weed) is but little known; it occupies a much smaller space between the 22d and 26th degrees of latitude, eighty leagues west of the meridian of the Bahamas. It is found on the passage from the Caicos to the Bermudas. In the latitudes just described, the fuci, far from being fixed to the bottom, float in separate masses on the surface of the water. In this state the vegetation can scarcely continue a longer time than it would do in the branch of a tree torn from its trunk; and, in order to explain how moving masses are found, for ages, in the same position, we must admit that, they owe their origin to submarine rocks, which, placed at the depth of 40 or 60 fathoms, continually supply what has been carried away by the currents. *It is not the Gulf-Stream, as some mariners think, which accumulates the fucus to the south of the Azores.*

"It were to be wished that navigators would heave the lead more frequently in the latitudes covered with weeds.

"The causes that unroot these weeds at depths where it is generally thought the sea is slightly agitated, are not sufficiently known. It has been said that, if the fucus adhere to the rocks with the greatest firmness before the display of its fructification, it separates with great facility after this period, or during the season which suspends its vegetation, like that of the terrestrial plants. The fish and the molluscæ, that gnaw the stems of the sea-weeds, no doubt contribute also to detach them from their roots.

"On proceeding hence, towards the West-Indies, from the 22d degree of latitude, we found the surface of the sea covered with flying-fish, which threw themselves up into the air 12, 15, or 18 feet, and fell down on the deck. I do not hesitate to speak of an object, of which voyagers discourse as frequently as of dolphins, sharks, sea-sickness, and the phosphorescence of the ocean. None of these objects can fail of affording interesting observations to those who make them their study."

Mr. Luccock, in his '*Notes on Brasil*,' has likewise described the *Green or Weedy Sea*. He states that it extends from 11 to 35 degrees of north latitude, and from 30 degrees of longitude, to an indefinite distance westward. "Here," he says, "the ocean is covered by nodules of sea-weed, from 3 to 18 inches in diameter, somewhat resembling, in form, a cauliflower when stripped of its leaves. They float lightly upon the water, in parallel lines, at a very few yards from each other, and have a yellow-brown colour, like the long stringy fibre which is sometimes seen floating in the English Channel, and which I suppose to be the natural colour of all marine plants growing deeply beneath the surface of the water. These nodules or spheres are composed of a vast number of small branches, about half an inch long, which shoot from each other at an angle of about 40 degrees: hence they multiply continually toward the superficies of the sphere; and each extreme point produces a round seed-vessel. This is little more than one-

tenth part of an inch in diameter, is hollow, and contains a small reddish brown seed, scarcely occupying one-fifth part of the husk. The leaf of the plant springs from the joints of the branches, is oblong, indented at the edges, and about an inch and a half long, a quarter of an inch broad.

"When the nodule is dexterously taken up, all the branches may be traced to one principal stalk; and this invariably shows a fracture, the part by which it has been joined to some larger stem. This fracture is frequently quite fresh, and, in large and vigorous plants, shows distinctly a woody part and a cortex. On the edges of the latter the first symptoms of decay appear. They become brown, and separate themselves from the wood. This also then assumes a darker colour, and exhibits the regular process of disorganization, just in the same manner as does a slip from a currant or gooseberry bush. In process of time, the whole of the plant assumes a darker hue; and, as it decays, floats considerably lower than it did. When kept out of the water for a few hours, it becomes harsh and brown, and acquires the peculiar smell of marine vegetables in a state of putrefaction.

"Sailors say that this weed grows in the Gulf of Mexico; that it passes round Cape Florida with the stream; and, proceeding between Bermudas and the Western Islands, settles in the eddy of that vast current which encircles the northern Atlantic. To me, however, this hypothesis appears to be inadmissible, not only because there is an evident absurdity in supposing that plants may move rapidly in a still water, which the word eddy here must signify, but because it is impossible for the floating body to move faster than the current does, and in a direction differing from the set of the water. By every observation and enquiry, which I have had an opportunity of making, no uniform current has been found to exist, capable of carrying the nodules in the direction specified, and to parts of the ocean where they are found; and no one, I think, who has considered the subject, will contend that there can be one capable of conveying them through a course of four or five thousand miles, before the plants show symptoms of decay. In this case, too, the *most vigorous plants must be found on the northern verge of this sea*, and the most decayed ones towards its southern limits, which is, indeed, *directly contrary to fact*; for, in the latitude of 11 north, we meet with slips which bear evident marks of being recently torn from their parent stems, and the seed-vessels there are often unusually fresh and flourishing; while, on the northern borders, we sometimes find them perishing, and even decayed; neither of which cases could occur if the plants floated southward.

"It is more reasonable to suppose that the plants grow nearly on the spot over which they float; that those which appear on the surface of the water are only the heads, or minor branches, of others, which flourish beneath; that they are broken off by the agitation of the ocean, or some other accidental circumstance, perhaps by the buoyancy of the seed-vessels themselves, which, at a great depth, must be fully sufficient for the purpose, as it enables them to float lightly even on the surface of the water. There the plant is exposed to the sun, the seed ripens, the pod bursts, and the contents descend again to form new plants; while the old ones decay and furnish manure, according to the established economy of nature among vegetables, both terrestrial and aquatic.

"A great number of very minute barnacles are found upon the leaves and stalks. The seed-pod is usually enveloped in a sort of honey-comb work, which may be taken from it, and, when examined by a lens, resembles, in appearance, the net-work in a fly's eye. Its substance, I conjecture, is coralline. Among other inhabitants of the plant is frequently a number of small crabs, perfectly formed, and evidently young, yet vigorous and active; and, when a nodule, taken fresh from the water at night, is hung up in a small cabin, it emits phosphorescent light enough to render objects visible.

"The singular arrangement of the plants, in parallel lines, is evidently owing to the wind, whose direction they always observe. Each nodule places itself under the lee of its more windward neighbour, and thus observes the law of floating bodies when exposed to a current of air. Should the wind suddenly change, as it sometimes does, a point or two, in this part of the Atlantic, and blow strong, these lines become broken, and form what are commonly called *fields of weed*. These, however, are generally small, and seldom, I suspect, remain long so disarranged.

"In the month of October I have run with a fine schooner, due north, through the N.E. trades, in the longitude of 26° , and found no weed, being perhaps to the east of it. In the month of March, on board a different vessel, we formed a diagonal line, from 26°

to 44° west, across the parallels from 11 to 44 degrees, and saw a great quantity of it. In May, of another year, along the same track, there was much less observed; yet I dare not say that these dates are sufficient to point out the season of ripening, maturity, and decay, of the plant; although I have never taken up a nodule which was not full of seed-pods, and never heard of a person who had noticed one destitute of them. It is said that whales come down to the vicinity of Bermuda, at a particular season, and feed upon these plants; yet I do not recollect ever seeing an individual of that species in the weedy sea; but, on the contrary, have noticed a deficiency of fishes in general; and most, if not all, of those which I have seen opened on board, appeared to live, not upon vegetable food, but their fellow-inhabitants of the waters. It is probable, however, that none but such will take a bait or approach a vessel."

7.—THE CAPE VERDE ISLANDS.

The CAPE VERDE ISLANDS derive their name from the nearest point of the Coast of Africa, and consist of the Ilha de Sal, or Salt Island; Bonavista; Mayo, or the Isle of May; St. Iago; Fuego, or Fogo; Brava; St. Nicolas; Sta. Lucia; St. Vincent; and St. Antonio; besides several small islets. Of these isles the most considerable is St. Iago, the chief town of which is the seat of government.—*For the positions of the chief points, see pages 23, 24.*

We have already shown (pages 131 and 132) the usual courses and allowances to be made in sailing to these islands; and have there noticed the fogs by which they are frequently surrounded. The estimated limits of the N.E. trade-winds, in the vicinity, may be seen in pages 59 and 60. Thus much premised, we immediately proceed to the description of the isles.*

ILHA DE SAL, OR SALT ISLAND.—The Isle of Sal, lies between latitude 16° 34' and 16° 51'. The meridian of 23° W. according to the late survey, passes through the middle of it. The northern part of the isle is mountainous; the southern very low and sandy. Both the eastern and western sides are irregular, and the former has an almost continued reef, along shore, from North to South.

SAL derives its name from the salt-ponds upon it, wherein the water crystallizes into a beautiful salt, the chief production of the isle; as the land is so barren as to bear no trees, no verdure, excepting a few inconsiderable shrubs.

On approaching the island from the north, it will be found, in general, that the currents are very irregular. You may, on approaching, see the high land at 14 leagues off. Sometimes at a greater distance. This land makes in three hummocks, of which the northernmost is the highest. This is the *Peak of Martinez*, in the N.E., the summit of which is 1340 feet above the level of the sea.

The best roadsteads of Sal are on the western side of the island; but there are three little bays on the eastern side, and one on the south. The middle bay on the eastern side, where a ship may lie, is apparently sheltered from the N.E. by a sandy reef stretching out to the eastward, and here salt may be obtained.† The other bays on this side are open to the N.E. trade wind, which makes a very heavy sea on the beach.

Great caution is required on approaching the south end of the island in the night, it being so low as hardly to be seen at 10 miles off in the day. Keep your lead going, and approach no nearer than in 30 fathoms, unless bound into the *South Bay*, which lies between the S.E. and South points of the island.

* Mr. Finlaison has said that, "In leaving Tenerife for the Cape Verde Islands, you will certainly have the wind from E. by S. to N.E. as you approach the islands. He also adds that, in the passage, a current was generally found setting from S.S.W. at the rate of half a mile an hour, which is contrary to the current on the African coast.

† **Firestone Hill.**—A promontory on the eastern coast, stands at two leagues from the North Point. At the back of this is the Salt-pond Hill, a natural curiosity, as upon this is the salt-pond, 150 feet above the level of the sea. The surface of the pond, in a circular form, is 45 feet below the top of the hill.

The S.E. point of Sal is now called *Wreck Point*, the sloop *Erne* having been wrecked near it in 1819: this is surrounded by a reef. From *South Point*, forming the west side of the bay, a dangerous sandy spit extends about one mile into the sea. If coming into the bay, between these points, after rounding *Wreck Point* in 8 or 9 fathoms, bring that point to bear E. by S. and the opposite point W. $\frac{1}{2}$ N., and anchor in 9 fathoms, sandy bottom. Here you will be sheltered from the N.E. trade, and lie in perfect safety.

At 5 miles to the west, from the *North Point* of Sal, is *Manuel* or the *N. W. Point*. Nearly true South, $8\frac{1}{2}$ miles from the latter, is a little islet, called *Bird Isle*, near a promontory, *Lion's Head*, which is 620 feet high. At a league to the northward of *Bird Isle*, is a small bay, called *Palmyra Bay*, and immediately to the south-eastward of the *Lion's Head*, is *Mordeira Bay*, which is one of the best in the Cape Verde Islands.

MORDEIRA BAY is in a semi-circular shape, one league in extent between its outer points, *Lion's Head* and *Turtle Point*. It is a safe anchorage during the N.E. breezes. Captain Bartholomew says, that it has plenty of fish and turtle, but has no watering place; nor could that article be procured by sinking casks in the sand.

The principal mark for anchoring in *Mordeira Bay* is, *Bird Island* just shut in with the foot of *Lion's Head*, at a mile and a quarter from the bluff land; there are several foul spots; therefore the ground should be examined before the anchor be dropped.

From *Turtle Point*, the *South Point* of *Mordeira Bay*, to the *South Point* of *Sal*, the distance is one league and a half: the ground between is smooth, and has 7 fathoms over it, at half a mile from shore, which is sandy: but be careful, if you anchor, that the ground is clear. In rounding the *South Point*, with the spit extending from it, approach no nearer than in 10 or 8 fathoms, as the latter is steep.

The latitude of the *Lion's Head*, according to the late survey, is $16^{\circ} 41'$; long. $23^{\circ} 0' 15''$. Variation, observed on shore, $15^{\circ} 20'$, W. High water, 7h. 15m., rise 5 feet.

Between *Sal* and *Bonavista* there is, generally, a strong current.

BONAVISTA.—The Island of *Bonavista*, properly *Boavista*, or *Good Sight*, has been so called from the beautiful appearance it made to the first discoverers, in the year 1450. The face of it is variegated; partly low, partly rocky and mountainous; formerly fertile, now more barren. Salt is the principal article of trade, which the inhabitants readily exchange for old clothes, biscuits, meal, and raw silk. The principal place is *ENGLISH ROAD*, on the N.W.

The eastern side is partly environed by a reef; and, on the N.E., are the reefs on which the *Hartwell*, East-Indiaman, was lost, in 1787; and on which the *Resolution*, Captain Cook, was nearly driven by a southerly current. Half a league nearly, from the west end is a coral reef, on which the sea breaks; and, at times, the current sets on it very rapidly.

From the south end of *Sal*, the N.W. point of *Bonavista* lies true South, or S. by W. $\frac{1}{4}$ W., by compass, distant seven leagues; and, from the same end of *Sal*, to clear the N.E. reefs, the course, by compass, is S.E. by S. 11 leagues, in order to allow for the current that sets to the S.W. on *Bonavista*: be sure to make this course, and it will bring you to the eastward of these reefs; the easternmost part of which lies in latitude $16^{\circ} 10'$.

Bonavista is of an irregular shape, but nearly octagonal, and each way three leagues in extent. Its eastern side is low, but the interior is mountainous, and a ridge of high land from N.W. to S.E. divides the island into two unequal parts. Of this inland chain *Mount Juan Fernandez* is the northern part, and the southern is called the *South Mountain*. Two miles from the N.E. end is another eminence, *Mount Ochel* or *Ochello*: at the N.W. end is the *Peak Reshee*, and in the S.W. is the *Platform Hill*, with an elevation within it, called the *Man Mountain*. *English Road*, on which the town is situate, forms a bay, 5 miles in extent from N.E. to S.W., and its northern part is protected by an islet, called by the English *Small Island*. The south point of this bay is *Coral Point*; and off this point, which is foul, at the distance of half a league, is a coral reef.

Off the N.E. coast, as shown above, are the *Hartwell Reefs*, and three kays, called *Duteh*, *Braithwaite*, and *North Kays*. Between these is sufficient depth of water for ships, in case of necessity, and proper depths for anchorage, under the lee of the reefs; but many rocks are here. scattered, with only 12 or 13 feet over them, and 4 fathoms close

close along them, on which, with a wind, the sea breaks very high. Of the channels between these reefs, the best lies between a ledge to the E.S.E. of Braithwaite or the Middle Kay, which is always visible, and Dutch or the South Kay. This channel is three-quarters of a mile broad, and has regular soundings, from 15 to 5 fathoms; having been tried by H. M. sloop *Bull-dog*, which often sailed in and out of it, and several times anchored under Braithwaite Kay, with that Kay N.E. by E., Dutch Kay S. $\frac{1}{2}$ W. You may moor at half a mile from Braithwaite Kay, in 6 or 7 fathoms, tolerably good ground.

Braithwaite Kay is about two miles from the shore. The passage to the north-westward, between this and North Kay, is half a mile broad, and its least water is 7 and 8 fathoms. The passage between Dutch Kay and Bonavista is narrow, but in the best water are 7 fathoms. Dutch Kay bears from Braithwaite Kay S. $\frac{1}{2}$ W. [*S. by E.*] 2 $\frac{1}{2}$ miles.

The *North Kay* is connected to the shore by a reef, having over it only 5 feet of water. When this Kay is in a line with the summit of Mount Ochell, or the N.E. high mountain in Bonavista, it bears about W.S.W. $\frac{1}{2}$ W.

In sailing out to the south-eastward, with the wind easterly, stand well to the southward, taking advantage of the current here setting easterly, and take care not to borrow too near the back of the reefs.

The *Brazen Hill* and *Point*, in latitude 16° 2', on the S.E. coast, is the first high land to the southward of *East-sand Head*, which is the easternmost point of Bonavista. The *South Point*, which is nearly 3 leagues more to the south-eastward, is low and foul, and an islet, of the same description, lies at three-quarters of a mile to the eastward. To the westward of the point is anchorage, in what is called *Portuguese Road*, with the Platform Hill bearing about N.N.W. and nearer in shore, in from 13 and 14 to 8 and 6 fathoms. In the latter depths the landing place will bear N.E. by N. more than a mile distant.*

NORTH and WEST COASTS. From the *North Kay*, off Mount Ochell, already described, the coast is foul to *Broyal Point*, on the north coast; and there are several reefs between the latter and the N.W. end of the islands, which is called the *North Point and Reef*. Small island, which forms the N.W. side of English Road, is 4 miles hence to the south-westward.

ENGLISH ROAD is a safe anchorage during the summer months, while you have the N.E. breezes, but there are three reefs in it, as shown on the new charts. Vessels generally haul close round Small Island, in 6 and 7 fathoms, and pass within the first reef (of 10 feet) in order to avoid the necessity of making a tack to get to the anchorage. The best mark for the latter is, the town open with the N.E. end of Small Island, and the highest part of that isle about N. by E. The Ten-feet Reef generally shows itself, but when this is not the case, a stranger will do well to stand outside, rounding it at about 1 $\frac{1}{2}$ or 2 miles from Small Island, approaching it no nearer than in 6 fathoms, and after once opening the town taking care not to shut it in again.

The new town is on the middle of the bay, and the second reef (*New-town Reef*) lies to the westward of it, at a short distance from the beach. The *Inner Reef* lies, in like manner, half a league more to the northward. The Ten-feet reef is about 100 fathoms in length, and extends nearly east and west, at rather more than a quarter of a mile from Small Island.

Mr. Keilor has said, "We experienced, in a calm, a very large sea, breaking in every part of the bay, and were, at the same time, riding with a very short scope of cable, by reason of a strong current setting out of the bay, against the sea: this current runs so high as to frequently break on the deck."

In the rainy season, which is during the months of July, August, and September, the Island of Bonavista is subject to light airs of changeable winds, with heavy swells in the bay and roadsteads.

The tide flows, in English Road, at half-past two, on full and change days, and the sea rises 5 feet. Observe that there is no fresh water for shipping at Bonavista. There is water, but not plenty of it, near the Portuguese Road.

* Mr. Finlaison says, that it is requisite to give the point under Platform Hill a good berth, as there is a reef extending three miles off. In the day you may see the sea breaking on it. The Mountain E.N.E. clears the danger.

LETON ROCK, or **JOHN LETON'S ROCK**; a dangerous reef, lies, as shown in the table, page 23. This shoal has heretofore been variously represented, and described as just even with the surface of the sea, which breaks upon it with great violence. The bottom about it is rocky, and swarms with fish. Its extent from N. to S. is about a mile.

From the centre of the reef the North Point of Bonavista, bears N.E. $\frac{1}{2}$ N. [$N. 26^{\circ} E.$] $9\frac{1}{2}$ leagues, and the South Point of the same E. by N. [$N. 64^{\circ} E.$] 7 leagues.

The lamentable wreck of the *Lady Burgess*, East-India ship, one of the outward-bound fleet of 1806, was caused by striking on the Leton Rock. This ship struck among the breakers on the Rock, at two in the morning of the 19th of April, 1806. The *Alexander*, *Sovereign*, *Lord Nelson*, and other ships, narrowly escaped. The *Lord Melville* struck three times, and slipped off the rock into 25 fathoms, at the time the *Lady Burgess* was standing directly among the breakers. It appeared, from the observations subsequently made, that the Leton Reef is composed of coral; no part above water. Captain Swinton, of the *Lady Burgess*, conjectured that the extent on which a ship would strike is not above a cable's length, and that there are no breakers on it in fine weather. To the northward it appeared to be steep-to.

This danger appears to be on the central part of an extensive bank of coral soundings, extending 4 or 5 miles to the southward, and considerably to the eastward and westward. At day-light the ship *Asia* was in 52 fathoms, coral bottom, when the breakers and wreck bore E. by N., about 4 miles distant. Other ships had soundings of 25 to 50 fathoms to the W. and S.W. of the reef, at from 2 to 5 miles from the breakers. Immediately after striking, the *Lord Melville* had 25 fathoms, its head being to the eastward; shortly after, 30 fathoms. This ship hove-to, with her head easterly, until day-light, and had from 30 to 40 fathoms, all coral soundings. Others had soundings 10 or 12 miles to the southward of the reef, generally coral, sometimes intermixed with sand and shells, and not less than 20 fathoms. The mean of the observations and chronometers of the fleet, gave $15^{\circ} 49' N.$ and $23^{\circ} 14' W.$, as the situation of the reef, which is on the meridian of the Isle of May: its situation, according to the late survey, is $15^{\circ} 48' N.$ and $23^{\circ} 13' W.$

ISLE OF MAYO.—This island is raised considerably above the sea, but a great part is level, excepting three inland mountains, of considerable height. On the S.W. side is a sandy bay, called *ENGLISH ROAD*, within which is the town and extensive salt-pans. The soil of this isle is generally dry and unproductive, and there is but one spring of water in the island. The coast is, however, plentifully stocked with fish, which supply, with a few vegetable productions, subsistence to the poor inhabitants.

From the S.W. end of Bonavista to the island of Mayo, the course is S.W. by S., distant 15 leagues; Mayo is about 4 leagues in length from N. to S., rising most towards the middle. On approaching the island from the S.E. the appearance is very different; you may descry, in the north part, two hummocks, which appear like two islands; but, when nearer, the land is perceived, by which they are connected. Southward of these, is a mountain, (*Monte Mayo*), with very low ground to the south, over which two hillocks are seen.

At half a league from the middle of the north side of the island is a reef extending N.N.E. and S.S.W. three-quarters of a mile, which must be cautiously avoided.

In *English Road*, ships may anchor in 7 or 8 fathoms of water. The landing is very indifferent; no good water to be had; and the place is quite defenceless. The shore to the eastward of and abreast the town is steep, bluff, and rocky; but to the westward, a low white sandy beach extends to a rounding point from which a spit of sand and coral stretches outwards, at a short distance from the extremity of which there is no ground at 45 fathoms. The spit may be rounded in about 16 fathoms, and a ship should not anchor farther out than in that depth, the edge of the bank being steep. At half a mile west from the town there is anchorage in 12 fathoms, lat. according to *particular plan*, $15^{\circ} 6' 10''$ long. $23^{\circ} 15'$. Variation on shore $15^{\circ} 16' W.$ 1819.*

ST. IAGO.—Ships running from Bonavista to St. Iago, and being obliged to ply to windward during the night, must be cautious how they approach Mayo, on account of the reef, before mentioned, off the north point of that island; having doubled that point,

* For Lieut. Mudge's Remarks on the Magnetic influence of Mayo, see Note 2, page 24.

they may steer S.W. to make the land of St. Iago, and thence southward until they make the Road of Praya, the common place of anchorage.

The land of St. Iago is very high, and the eastern coast is bordered with rocks, lying very near the land, along which you may sail very safely, at the distance of two miles. The S.E. part appears as a long low point, when you are to the northward or southward of it; and, from this point S.W. by S. true, about 6 miles, lies the east point of Porto Praya. Between the two, and near the former, lies a bay, which so much resembles that of Port Praya, that many vessels, deceived by the likeness, have run the hazard of being lost in this dangerous place: at the bottom of it are several cocoa-nut trees, and a few houses; the land between this and the point of Port Praya is mostly perpendicular, appearing, in some places, like the *Berry Head* in Torbay; and though the Fort of Port Praya, which stands on a small cliff, is a mark by which the true bay may be distinguished from the false one, yet the surest mark is, that the north or east point of the false bay is surrounded with breakers; whereas the point of Port Praya is high, steep, and free from shoals: you must haul close round the point, and keep within a cable's length of the shore to go to the anchoring-place. It may, also, be noticed that there is now a naval signal post on the cliff, at half a league to the northward of the entrance of Port Praya.

PORT PRAYA is a fine bay, which lies between two points, bearing from each other W. by S. and E. by N. true, about $1\frac{1}{2}$ mile. As you sail round the east point, you will soon open the point at the bottom of the bay, to the westward of which, in a valley, are several cocoa-nut trees and a small house.

The winds, except in the tornado season, are generally in the N.E. quarter, and frequently blow fresh and squally; there are, also, frequent puffs from over the high land; therefore, as you haul into the bay, it is necessary to have the top-gallant sails furled, and to take one reef or more in the top-sails. The cliffs, from the east part of the fort, are those above described: you may easily sail within a cable's length of the east land, where you will have 7 or 8 fathoms of water, and, in many places, see the ground at that depth.

On the western side of the bay lies a small black island, called the *Isle of Quails*, or *Frenchman's Island*; it is almost even to the top, but rugged at each end, and some rocks lie off each end to about half a cable's length: there is also a rocky ledge off the north end, where the water is, in general, shallow: you will not have more than 3 fathoms of water between this and the fort; inside, or to the westward of the island, it is navigable for boats only.

Captain Grant, in the relation of his voyage to New South Wales,* has stated that, after rounding the S.E. point of St. Iago, there is a small bay to the East, about 4 miles, called by the inhabitants after St. Francis. This bay, he says, may be always known, by its having, at the back of it, and nearly close down to the water's edge, a high flat-topped table land, standing between two mountains, which cannot be mistaken. Port Praya has, at the bottom of it, besides the house already mentioned, a long low valley, running inland to a considerable extent, the mountains behind which are sharp and peaked. Near the landing-place there are two remarkable forts on the east side, which you must open before you come to anchor; and, on the west side, is Quail's Island, which is readily seen as you enter. But the surest mark is that, from the S.E. end of the island of St. Iago, the shore is low and rocky in general, until you reach the bay of St. Francis: thence to Port Praya the shore is of high clayey cliffs, which round into the harbour, forming the East side of it.

"Since the commencement of the last war, two forts have been erected, one of fourteen, the other of eleven, guns. They are both inclosed with a wall, kept in good order, and white-washed, which make a pleasing appearance. There are, also, several redoubts, with guns mounted in them, but in a ruinous state. The inhabitants are chiefly black, a few officers about the governor excepted. The troops appeared to be natives of the island, black, and poorly clothed. From the height that the forts and town stand on, a tolerable defence towards the sea might be made; but, if an enemy were landed the island would instantly fall: particularly as it has few internal resources, and even water is brought from a well in the valley at the back of the town, the only place where

they get water in the dry season, which could be cut off. At the time we were here, the ground was parched up, exhibiting a barren waste, scattered with pumice-stones and other volcanic matter."

It seldom rains here, but a dry haze is very prevalent. In December and January the wind is frequently far to the eastward, veering, at times, to the northward in the same season. In settled weather, there are often regular land and sea breezes in the bay; the sea-breeze setting in near noon, with a great surf on the shore, and ending at four or five o'clock in the afternoon. The N.E. wind sets in towards evening, and continues during the night. As there is generally some surf on the beach, boats should lie at their grappels; and the casks of water hoisted into them, after being filled at the well, and rolled down and floated through the surf. By sending a pump on shore to place in the well, ships may be sooner watered than if the water be drawn up by buckets; and some planks taken on shore will be useful to place under the casks, when rolling down either over stony uneven ground or soft sand.

For sailing into Port Praya Bay, you may borrow on the eastern point (*Ponta das Bicudas*) to 7 or 8 fathoms of water, and thence proceed north-westward, to the anchorage. It is to be noticed that the ground is foul in different parts, particularly on the western side.

The best anchorage is, to bring the flag-staff on the fort N.W. by N. [*N.W.*] about three quarters of a mile, the body of Quail's Island West, and the point of the bay opposite Quail's Island, E. by S., in 7 and 8 fathoms. Many commanders prefer anchoring nearer the northeast side of the bay than the Isle of Quails, for the sake of more easily getting under sail, without running the risk of being carried by the currents upon the points of rocks to leeward, before the vessel has gained fresh way enough to steer clear of them: and it has been observed that, vessels may anchor any where in the bay, from 9 to 11 fathoms, good bottom, but nearer to the eastern shore than to the Isle of Quails: as the wind, except in the months of August, September, and October, generally blows from the N.E.

H. M. ship *Tartar*, Sir Geo. Collier, anchored with the best bower in 11 fathoms, nearly in a line with, or a little within, the two outer points, ground of sand and bits of coral. Quail Island then bore N.W., the flag-staff of the fort N.N.W., and East point of the bay E. $\frac{1}{4}$ S. A salute of thirteen guns was returned. Stock of all kinds was in great plenty.

"The Bay of Praya being under the south end of St. Iago, should you be to the leeward of it, you will find it difficult in beating to windward against so strong a current as there is here. In the months of July, August, and September, the rains are frequent, and the southerly winds, which then prevail, cause a great sea in the bay, with a great surf on shore. The inhabitants, in these months, are subject to dangerous fevers."

For the position, see the Table, page 24. For the tides, page 78.

Ships bound to the East-Indies may touch at the island of St. Iago for refreshments. It produces plenty of oranges, lemons, limes, grapes, cocoa-nuts, pine-apples, and other fruits: there are also cattle, goats, pigs, fowls, turkies, and game, in great abundance, and at very reasonable prices. A company has the exclusive privilege of selling cattle to strangers, and all the European goods to the natives; these, however, have the liberty of exchanging their commodities, except oxen and cows, for old clothes, and especially for old shirts, which always fetch a good price, provided there be no hole in them, and they have ruffles; for a single old shirt you may have ten or twelve fowls, and two old shirts will purchase a hog; blankets, also, are in great demand. (*This was written some years ago.*)

To the foregoing observations, the following, by an officer of the *Argo*, 1802, may, with propriety, be added:—There are two wells, from which water is obtained; the farthest, on the west of the town, is the best, and the water good. The casks must be rolled up to the well, and back again, which is the most tedious part of the business. The water is drawn from the well by buckets, sent on shore for that purpose, and a tail-block, made fast to a branch of a tree, which hangs over the well. The boats will sail on and off shore. Oranges are extremely cheap. The bullocks are small, but good for the climate; and they, with the other articles, may generally be had much cheaper for cash than bills.

The sandy cove, on the east side of the bay is an excellent place to haul the seine in ; as is, also, the head of the bay. The principal fish are the mullet, grey and red, rock-fish, snappers, cavalla, and a variety of small fish.

Besides the articles above mentioned, the island produces Indian corn, coffee, sugar, and cotton. Indigo grows wild. The sugar is good, and made in small loaves, sold at about a bit, or sixpence, per pound.

The governor-general of the Cape Verde Islands resided, formerly, at St. Iago, an episcopal city, and the capital of the island ; but foreign ships having totally abandoned the road of St. Iago, which is very bad, and of difficult access, to come to that of Praya, the governor now resides at this bay.

To those bound from Praya Bay to Bonavista, Mr. Keilor recommends that they should endeavour to sail in the evening, as the current will be favourable ; he adds, do not stand too far over towards the African shore, nor work between Mayo and St. Iago, and you will find the ship get to the eastward very fast.

FUEGO or FOGO.—This island, much higher than any other of the Cape Verde Islands, is only a continued mountain, rising into a peak of great height, which burns continually. The height of this peak is 1626½ fathoms above the level of the sea. This island has, nevertheless, some inhabitants, whom the eruptions of the volcano force sometimes to quit the island. The ground is clear within a mile of the shore, on the N.W., West, and South, parts ; but, on the S.E., East, and N.E., parts it is rocky. At about 4 miles from the north end of Fogo lies a rock, with 12 or 14 feet of water on it, over which the sea breaks when it blows hard, but not else, and the sea is clean all round it.*

The town is that of *Nostra Senora da Luz*, or *Luz*, on the western side. The roadstead is open, and the anchoring ground off the town very close in, being only half a mile from the shore. In 25 fathoms, rocky bottom, the northern extremity bears N. 20° E. [N. 4° W.] ; the southern extremity, S. 68° E. ; the northern flagstaff N. 85° E. ; the southern, N. 21° E.

No other soundings are to be obtained near either Fogo or Brava with a line of 130 fathoms, at three quarters of a mile from shore.

The marks, says Mr. Keilor, when a brig was at anchor off the town, in 10 fathoms of water, were, the town bearing E. by N., a quarter of a mile ; the Mount, E.N.E. ; the south end of Brava, S.E. by S. The bay is open, with foul ground, and a bad landing for boats. Corn, fruit, and cattle, may be purchased at Fogo, but water is scarce.

BRAVA.—The channel between Fogo and Brava is nine leagues in breadth. Five miles to the N.N.E. of Brava are several islets, which are high and steep-to : of these, the easternmost is two leagues to the westward from Fogo. I was informed, (says Mr. Keilor,) by the *Braithwaite*, that there is a harbour in Brava for small vessels ; but, the entrance being under the north-east part of the island, the trade-wind blows right in ; and, as the winds here prevail at N.E. or East, most part of the year, excepting in July, August, and September, it is not advisable to run into it. Here is plenty of corn, livestock, and fruit ; but bad landing for boats, except in the harbour.

This island is very high, its mountains rising one above the other, like pyramids ; yet, being so near the isle of Fogo, it seems, in comparison, to be but low. It produces plenty of salt, and abounds most with salt-petre of any of the islands. According to Captain Roberts, " Brava has several bays or roads, where a ship may anchor, the best of which, called *Furna*, or the *Oven*, lies towards the north-east end of the island ; if you haul in near the rock, which is a very good kay, having water enough by the side for a first-rate man-of-war, you will lie land-locked from all winds ; nor does any wind blow in there, except from the S. by E. to the S.W., which heaves a sea into the bay, and makes it very well deserve the name of a harbour."

The natives of Brava are all blacks, and very few ; you will find them the most harmless, hospitable, and generous, of all the islanders.

* Not inserted in the Admiralty chart : its existence is, therefore, questionable.

St. NICOLAS.—At this island vessels of different nations occasionally touch for refreshments; which are sold at moderate prices. The land is mountainous, and the coasts therefore subject to heavy squalls, &c.

From English Road, in Bonavista, to the East Point of St. Nicolas, the *true* bearing is W.N.W. and the distance 22 leagues: the course must be regulated according to the set of the sea. The east end of the island may be known by its being a platform point, having a pyramidal rock, which appears like a sail, at a short distance.

On the south side, at a league and a half from this end of the island, is a bay, having a pond of fresh water, abundantly supplied from the mountains, and hence called, by the English, *Freshwater Bay*. To anchor in this bay, shut all the land to the eastward within the east point of the bay; you will then lie in 7 fathoms of water, within half a mile from the shore. There is good landing for the boats, with plenty of good water in fine weather, and at neap tides; for, as the tides rise here 5 or 6 feet on the new and full moon, the pond is then overflowed. At this time you are subject to heavy squalls; and, notwithstanding the wind blows off shore, the sea is very high close to the beach.

At about 4 leagues to the westward from the middle of Freshwater Bay, lies *St. George's Bay*, where a ship can get refreshments; but there is no water. This bay is known by a sugar-loaf mount, and a flag-staff on the hill above the bay: there is tolerable good anchoring in 7 fathoms, close to the shore; but, without that depth, or in 9 or 10 fathoms, the ground is rocky. There is a shelf stretching S.E. by S. from the N.E. point of the bay, on which less water is found than within it; so that, should your anchor start, which will happen if you are not careful, the bank being very steep, and the squalls very sudden, it may hook this shelf and be lost. The marks to anchor are, the cove, or landing-place for boats, N.W., distant a quarter of a mile; Sugar-loaf Mount N.E. by E., and the flag-staff N.W. by N.

On the S.W. side of St. Nicolas is *Tarrafal Bay*, where you may anchor in from 20 to 10 fathoms, with the coast to the southward bearing S. by E. and the Islands Raza and Branco in a line bearing N.W. by W. $\frac{1}{4}$ W. [*W.N.W.* $\frac{1}{4}$ *W.*] and the landing place E. $\frac{1}{2}$ N. a quarter of a mile.

The Custom-house is situate on the S.E. angle or corner of this bay. From this to the West point of St. Nicolas there is a bank of soundings, with from 40 to 20 and 35 fathoms at half a mile from shore. In the last depth is anchorage, in sandy ground, at a mile S. by W. from the West point, but sheltered only from the N.E.

There is, in Tarrafal Bay, a high bluff rocky point, near a quarter of a mile short of the sea-side; in which place it is low, stony, gravelly, and, in some places, shingly, ground; the shore being a pebbly beach. On each side of this point is a very deep gully, out of which come violent flaws or gusts of wind; and, therefore, when any thing of a hard gale blows, it is very difficult to turn up into this bay. To avoid these flaws, you must anchor right against the point, between the gullies, where you may ride very easy under its lee, in from 16 to 3 fathoms.

Within this Bay the depths are 12, 13, and 14, fathoms, soft ground; and then they shoalen gradually to the shore, to the depths of 4 or 5 fathoms, where you have again sand to the pebbly beach.

By digging a well, almost any where on the low land, you may water here, unless the rainy season has failed; but there is always water in the valley, about half a mile from the sea, whence the natives will bring it down on asses for a trifle. From this road you may see, in clear weather, all the leeward islands; but, if it be in the least hazy, the Isle Raza is not discernible.

RAZA, BRANCO, and St. LUCIA.—These islands, which are uninhabited, lie between those of St. Nicolas and St. Vincent, as shown on the charts. Rugged and mountainous, they partake of the general character of the other islands. Raza lies *true* West 8 miles from the West Point of St. Nicolas, and appears in the old charts under the name of *Chaon* or *Dog's Isle*. It is nearly two miles long, from E. to W. and $1\frac{1}{2}$ broad. The landing place is under the N.W. point facing the West.

BRANCO, the Redonda of the old charts, is a league to the N.W. of Raza, and much higher. In the passage between are soundings of 6 to 13 in the middle, and, decreasing near Branco, to 7 fathoms. The latter is a narrow island, $2\frac{1}{2}$ miles long from S.E. to N.W. A spit of sand stretches from its S.E. end, and its shore is altogether rocky.

ST. LUCIA lies at the distance of $3\frac{1}{2}$ miles to the northward of Branco, and the Bank of soundings extends to this island. The bank here forms a regular flat of 10 to 13 fathoms. The south coast trends nearly E. and W. 4 miles, and in the middle of it is a good landing place. A steep bank, half a mile broad, stretches from it, having on its edge 2 to 4 fathoms. In the bay formed by the S.W. coast, are the ruins of a village, at three quarters of a mile from the south point. To the westward of this is a little islet named *Leon*. The N.W. part of St. Lucia rises into high mountains.

These islets are occasionally visited by parties from the other islands, for the purpose of hunting wild bullocks and goats.

ST. VINCENT'S. The island of St. Vincent is separated by a channel, 4 miles broad, from that of St. Lucia, and by one of 7 miles from that of St. Antonio. This island is 11 miles long, from E. to W. and about 6 broad. It has two chains of mountains, facing the N.E. and S.W. which form a central valley that terminates in the bay called *Porto-Grande*, upon the N.W. side of the island. The N.E. coast forms two bays, separated by a low peninsula, of two miles on either side, and this coast has been described as altogether dangerous.

PORTO GRANDE is the largest and best bay in the Cape Verde Islands, it is capable of holding 300 sail of large ships, well sheltered under the high lands, and has a fine appearance. *Lieutenants Vidal and Mudge*, who surveyed this place, in 1820, say of it, that it forms a good and safe anchorage, where you may strip and refit your ship; as it is sheltered both from wind and sea. The wind generally blows from the N.E. over a part of the land, and seaward it is protected by the island of St. Antonio.

Wood is plentiful, and sufficient water may be obtained from the well, on the eastern shore, for daily consumption. After a refit here a complete supply of the latter may be found in the Bay of Terrafal, St. Antonio, which is 6 leagues to the westward, and reckoned the best watering place among the Cape Verde islands. Cattle may be had at Porto-Grande, but they are not very good. The church and custom-house are situate in the bottom of the bay on the east, and a signal post may be seen, erected upon a hill, at a short distance from the anchorage, which gives notice of whatever may be passing or approaching the island.

Lat. of the Custom House, $16^{\circ} 53' 33''$, long. $25^{\circ} 3' 19''$. Variation, $17^{\circ} 46'$, 1820.

Without the entrance of the bay, at nearly three quarters of a mile from its N.W. point, is a remarkable steep islet, called *Bird Isle*, which, at a distance, appears round like a sugar-loaf. *Mr. Finlaison* says, you may run in on either side of it, and will find regular soundings thence to the shore; depths from 30 to 10, 8, 6, 4, and 2, fathoms, to the beach. The ground is good, in most parts of the bay, and you may anchor any where in 7 or 6 fathoms of water, sandy bottom, with coral branches. The water is very clear, so that you may pick out a clear spot for the anchor.

"Ships should moor with a kedge, as a very strong current commonly sets to the N.E. between Bird Island and the shore: and, as the N.E. wind is variable, at night it is impossible to keep a clear anchor, without this precaution; for the wind, at times, comes in strong gusts from off the land.*

Mr. Finlaison adds, "In running between St. Antonio and St. Vincent, we sounded in 42 fathoms, bits of coral mixed with sand and small stones. Within half a mile of Bird Island we had 42 fathoms.

"Having proceeded about 8 miles to the southward of St. Vincent's, 40 fathoms of water were found: and, on approaching *Still Bay*, at the S.W. side of the island, found regular soundings, oaze and sand, to 20 fathoms, nearly in the centre of that bay. We anchored in this depth, with the west Point of the Bay, W. by N. and its East Point E.S.E., the distance between the two Points is $2\frac{1}{2}$ miles; regular soundings from the ship to the shore and very good landing on the beach. Plenty of bullocks and sheep to be got here, on reasonable terms; the ground is perfectly clear of rocks, but the bay is open to the S.W. wind. Water is also to be got by digging for."

* In working between St. Antonio and St. Vincent, to Porto-Grande, you may stand to a mile off St. Antonio, and as near as you please to St. Vincent, as the current generally sets strongly through to the N.E.—*R. Keilor*.

Mr. Finlaison says, that ship's bound through this channel, should keep over towards the latter, as no danger whatever is to be apprehended on that side.

St. ANTONIO.—This island, as already shown, lies at the distance of 8 miles to the N.W. of St. Vincent, and it appears, altogether, like an assemblage of high mountains, particularly to the west. It is 22 miles in length, from E. to W. and about 11 in breadth.

Of the two highest mountains in the west, the *Sugar-loaf* is the most elevated, and both are commonly covered with clouds. According to the late survey, the *Sugar-loaf* stands in $17^{\circ} 4' N.$ and $25^{\circ} 20\frac{1}{2}' W.$ The island is very woody, but has plenty of goats, fruits, and salt; it produces wine, cotton, indigo, &c. There is a village, *Santa Cruz*, on its S.E. side, but the ground is not fit for anchorage.

Terrafal Bay, which is only half a league to the northward of the S.W. end of the island, has been already noticed (page 233) as the best watering place in the Cape Verde Islands, and other refreshments may here be purchased. The edge of the bank, with 40 fathoms, is about one-third of a mile from shore. At a cable's length within are 30 fathoms, and it thence shoalens inward to 20, 8, and 4 fathoms: the latter near the beach. Latitude of the Landing and Watering Place, $16^{\circ} 57'$; Long. $25^{\circ} 24' 48''$. Variation, in 1820, $16^{\circ} W.$

Of **St. ANTONIO**, Captain Monteath has said, "This island, the north-westernmost of the Cape Verdes, is high, and may easily be descried, in clear weather, at the distance of 18 leagues; by distances between the north limbs of the ☉ and ☽, 27th Feb. 1818, taken when the S.W. point bore N. by E. $\frac{1}{2}$ E., distant 25 miles, I made the longitude $25^{\circ} 35' 45'' W.$; and, by chronometer, $25^{\circ} 30'$; the mean of which places the S.W. end of the island in $25^{\circ} 25' W.$ From the atmosphere being hazy in the horizon, I was prevented from ascertaining the true bearing of the S.W. point at the time of observation; but, from bearings taken previous, with the ship's run corrected, I am inclined to believe $25^{\circ} 25' W.$ to be nearly the true longitude, and not $25^{\circ} 35'$, as had been previously stated."

After passing **St. Antonio**, as above, Captain Monteath, between the parallels of three and two degrees North, found the current to set S.E. by E. in the twenty-four hours: but, between 4° and 14° S. the ship was set eighty miles westerly in five days.

REMARKS MADE ON QUITTING CAPE VERDE ISLANDS, AND CROSSING THE LINE. *By Captain James Grant, R.N.*

"On the 27th of April, 1800, we had adieu to the Cape Verde Islands. On getting clear of the islands we found a strong current setting to the South, which differed our latitude, by observation, 30 miles more to the South than our distance would give.

"On approaching the line, we found various currents, with heavy squalls, and sometimes rain.

"On the 17th of May we had an observation at noon, which gave us latitude $8^{\circ} 11' S.$ and longitude $27^{\circ} 28' W.$ The wind in general at S.E. and S.E. by S. I followed the directions of M. D'Aprés, and the observations of Captain Cook, keeping a good point free, as I thereby expected to get the sooner to the South, and clear of the S.E. trade-wind, having crossed the equator in the longitude $20^{\circ} 30' W.$; by this we did not see any part of the Coast of Brasil. It may be proper to remark that, we found a current drifting us farther to the West than we had any reason to expect, and that the vessel's head was never farther to the West than S.W. by S., and sometimes S.W. by S. $\frac{1}{2}$ S., which, with 13° West variation, ought to have given us, with a S.W. by S. course, by compass, a S.S.W. true course; instead of which we have never been able to make better than a S.W. course. Of this I am the more certain, because we have not, these twenty-four hours, had occasion to steer on any point but one, S.W. by S. with a S.E. wind, and with every attention I could pay to the steerage. Such is the result of my observation. It is true that all voyage-writers, who have navigated for the purpose of discovery, take notice of the different currents about the equator, without being able to reduce them within any certain bounds or rate: and I much fear that this will always remain a source of error. These currents, as already observed, set to the westward; therefore I think our navigators in general, who cross the line at about 20° or $21^{\circ} W.$, might do it to more advantage at 12° , as by that means they will equally avoid the heavy weather experienced on the African shore.

"On my return to Europe, I found the winds as favourable for crossing the line in nearly the longitude 12° as I did in 20° ;* and, as the great point is to get into the variable winds, between the S.E. and N.E. trade, to cross, I found them equally so; neither had we more rain. If a vessel, therefore, crosses at about 12° degrees, she will not have so far to run to the West before she gets clear of the S.E. trade; and, if bound to the Cape or India, where it may be acceptable to have a sight of the former, or of the land near it, she will greatly shorten the passage, as it is well known that many have fallen in with Cape St. Augustine or C. Roque, on the Coast of Brasil, and, by so doing, were obliged to run from continent to continent, merely because they judged it useless or impracticable to cross the line under 20° degrees W. Independent of all this, there is another reason why, at certain seasons, the Coast of Brasil ought to be avoided; that is, between the months of February and July, when the winds hang much to the South, being generally from S.S.W. to S. by E. and S.S.E. This is an old remark made by many, but not generally mentioned by navigators who have laid down directions for navigating these seas. The current on the Coast of Brasil, from March to September, sets to the North; and from September to March, back again to the South. No doubt, in doubling the capes Roque and St. Augustine, the currents extend themselves more to the East, of which we had a sufficient demonstration, enabling me to account for the remarks already made.

"On the 18th, we were in latitude $9^{\circ} 50'$ S., longitude $28^{\circ} 28'$ W., by lunar observations. Ever since the 12th instant, we had no other than S.S.E. and South winds, blowing at all times very heavy and squally, with rain. This had impeded our course to the South very much, and carried us a long way to the West. Between the third and seventh degrees of South latitude, we observed the diminution of the strength of the current to the West."

REMARKS ON SAILING WESTWARD OF THE CANARY AND CAPE VERDE ISLANDS AND TOWARDS THE LINE. By Captain Flinders, in the Investigator, 1801.

"At day-break, 9th August, 1801, the island Palma was in sight, bearing S. 72° E. true, 10 or 12 leagues. Albacores and bonitas now began to make their appearance, and the officers and men were furnished with hooks and lines, and our harpoons and fuz-gigs were prepared. This day I ordered lime-juice and sugar to be mixed with the grog; and continued to be given daily to every person on board until within a short time of our arrival at the Cape of Good-Hope.

"We carried fair, and generally fresh, winds until the 15th, in the morning, when St. Antonio, the north-westernmost of the Cape Verde Islands, was in sight. At eight o'clock the extremes bore N. 69° E. and S. 13° W., true, and the nearest part was distant four miles; in which situation no bottom could be found at 75 fathoms. A boat was observed near the shore, and our colours were hoisted, but no notice appeared to be taken of the ship.

"The north-west side of St. Antonio is four or five leagues in length, and rises abruptly from the sea, to hills which are high enough to be seen fifteen or more leagues from a ship's deck. These barren hills are intersected by gullies, which bore marks of much water having passed down them. By the side of one of these gullies, which was near the place where we lost sight of the boat, there was a path leading up into the interior of the island. The S.W. and South points are low; they lie N. 14° W. and S. 14° E., true, and are five or six miles asunder. Between them the land hollows back, so as to form somewhat of a bay, which, if it affords good anchorage, as it is said to do, would shelter a ship from all winds between North and E.S.E. We did not observe any beach at the head of the bay; perhaps from having passed at too great a distance.

"Some distant land opened from the south point of St. Antonio, at S. 75° E., true, which I took to be a part of the island of St. Lucia.

"During the three days before making St. Antonio, the wind varied from the regular N.E. trade to E.N.E., and as far as S.E. by E.; and, at about the time of making the land, it dwindled to a calm. For three days afterwards it was light and variable, between North and S.E.; after which it sometimes blew from the N.W. and S.W., and

* This corroborates the remarks of M. la Perouse, page 59, and of M. D'Après, pages 114, 115.

sometimes from the eastward. These variable winds, with every kind of weather, but most frequently with rain, continued until the 23d, in latitude 11° N. and longitude 23° W., when a steady breeze set in from the south-westward, and the weather became more settled and pleasant. The clouds were sufficiently dense to keep off the intense heat of the vortical sun, but did not often prevent us from obtaining daily observations for the latitude and longitude. At the same time with the S.W. wind came a swell from the southward, which made the ship plunge, and opened her leaks considerably.

"The south-western winds continued to blow without intermission, and drove us, much against my inclination, far to the eastward towards the coast of Africa. One or two attempts were made to go upon the western tack, but this could not be done with any advantage until the 2d of September, when we were in latitude $3^{\circ} 50'$ N., and longitude $11^{\circ} 15'$ W. The wind had veered gradually round, from S.W. to South, as we approached the African coast, to the direction of which it kept at nearly a right angle. I had not fully adverted to the probability that the winds blowing upon this coast would prevail to a greater extent at this season, than at any other time of the year; otherwise, as I wished to avoid Africa, I should have passed some degrees to the westward of the Cape Verde Islands, and probably have carried the N.E. trade to the 12th, or perhaps to the 10th, degree of North latitude; and in 8° , or at farthest in 6° , the S.E. trade might have been expected.

"Captain Cook, in his second voyage, experienced the same south-western winds, and was carried so far eastward, that he crossed the equator in longitude 8° West. M. de la Perouse also experienced them, and both were here at the same season with ourselves; that is, in the months of August and September, when the African continent had received its greatest degree of heat.*

"Although I preferred to avoid Africa, it is by no means certain that a good passage to the Cape of Good-Hope may not be made, especially at this season, by steering round the Bight of Benin with the S.W. and South winds. It is probable that, on approaching the meridian of Greenwich, the wind would be found to return to the south-west, and perhaps more westward, and enable a ship to reach the 10th degree of South latitude before meeting the S.E. trade; in which case, the circuit to be made before attaining the western winds, beyond the southern tropic, would be much shortened." [Voyage, Vol. I. p. 28.]

8. BERMUDAS' OR SOMMERS' ISLANDS.†

THESE islands received their first name from Juan Bermudas, a Spaniard, by whom they were discovered in the year 1503; and were called Sommers' Islands, from Sir George Sommers, one of the first settlers, who was shipwrecked on their rocks in 1609, in his passage to Virginia. They extend N.E. by E. and S.W. by W. about 16 miles in length, and of various breadths, being shaped in the most irregular manner imaginable. They are surrounded with many dangerous rocky reefs, nearly even with the surface of the water, some of which extend above 8 leagues from the island, and render them very difficult of access. What renders the approach still more dangerous is, that the land is low, and a current often sets towards them from the S.W. The current is variable, but it is known that vessels have been carried by it out of their reckoning to the distance of many leagues.

The air here has always been esteemed extremely healthful, and the beauty and richness of the vegetable productions are perfectly delightful. The town of St. George, the capital, is seated on an island of the same name, which is the north-easternmost of the islands. The people are in general humane and hospitable. Their principal employ is building of sloops and small vessels. Upon the islands are plenty of wild fowl, and the sea about them is an excellent fishery.

Hurricanes and tempests are very frequent; as is to be expected from the proximity of the isles to the variable limit of the trade and other prevailing winds.

* See the preceding remarks, by M. de la Perouse, page 59.

† This description is principally from the communication made to the Trinity-House, London, by the late Mr. Murdo Downie, 1803. For some remarks on the currents about these isles, see page 112.

Vessels, in hazy weather, or in the night, must be very cautious in approaching, lest the wind or currents should set them on the reefs, or into some inextricable channel. Be particularly cautious in coming from the S.W., as upon the rocks off this end of the island, from S.W. to W.N.W., many ships have been lost.

The prevailing winds with fine weather in these seas, being from between the South and West, vessels from the West-Indies and America generally make these islands by running in their latitude from the westward. The best latitude for that purpose is $32^{\circ} 8'$, always having regard to a small probable current in the direction the wind blows; steering East, you will first see the land a little on the larboard bow, being two small sand-hills, close together, having a white house on the top of one, and cedar-wood on the other (these are called Gib's Hills): as you near the land, you will see Wreck Hill farther to the northward, appearing peaked, and joined by low land to that first seen; steer to bring Gib's Hill to bear E.N.E., and, when within 6 miles of the land, take care it is not to the eastward of that bearing, because of the rocks called the Long Bar. Then steer so as to pass within 2 miles of the south-east land; and, when Wreck Hill shuts in behind the south land, you are clear of the south-west breaker, and may steer along the south-east side of the island, at a mile distant from the shore, until abreast of St. David's Head, there being nothing to hurt a ship but what is in sight.

In running for BERMUDAS from the eastward, the best parallel is between latitudes $32^{\circ} 10'$ and $32^{\circ} 20'$, in which a ship may run boldly, as there are no rocks at any distance from the land.*

When running down a parallel for Bermudas, with a large wind, and not making the land toward night, but expecting to be near it, no vessel in this situation ought to lie-to, but should rather turn to windward under an easy sail until day-light, because of a probable current, as before mentioned, which has deceived many by bringing them unexpectedly among the rocks. The land not being high, (for Gib's Hill, the highest land in the islands, is but little more than 180 feet above the level of the sea,) it cannot be seen at any great distance from a small vessel; add to this, the thick haze that frequently prevails here, particularly in fine weather, renders making the land somewhat difficult, and, at times, precarious, unless the latitude be accurately ascertained; for instances have happened of vessels missing the islands; and, after a fruitless search, steering for the American Coast, in order to take a fresh departure for running down the latitude again.

The rocks and islands of Bermudas lie N.E. by E. and S.W. by W. about 9 leagues, and, in breadth, about 5. Wreck Hill forms the West Point, and St. David's Head the East. Round the West, N.W., and North, sides, is a continued and very dangerous ledge of rocks, beginning at the Long Bar, the south part of which lies 6 miles W.S.W. from Gib's Hill: trending then N.E. it is called the Chub-Heads, which, off Wreck Hill, lies 9 miles from the shore: the ledge hence rounds to E.N.E., and joins the North rock, which is always above water, and lies N.N.W. 12 miles from Catharine Point. From the North Rock the reef rounds East and E.S.E., and ends in Mill's Breaker, which dries at low water, and lies at N.E. 6 miles from Catharine Point, and N.N.E. from St. David's Head. The outer edge of this ledge is close and compact, leaving no passage through it for ships, excepting a small one near Wreck Hill, another by the North Rock, and one round Catharine Point. Round the outer edge of this ledge is a margin of soundings, of from one to two miles broad, having from 9 to 14 fathoms on it; there are, likewise, soundings for two miles from the shore round the N.E., East, and S.E., sides of the island; but, as the water here is deeper, it would be prudent for those who suspect themselves near the longitude of Bermudas in the night, or in thick weather, while between the latitudes of 32° and $32^{\circ} 40'$, to keep a lead constantly going; being assured, that, at 14 fathoms, they will strike the ground in time to avoid danger. The lead might be incased with tallow, for the greater certainty of striking ground: this precaution, I am persuaded, would prevent many of the wrecks that constantly happen here.

There is a rocky bank lying from S.S.W. to S.W. from Gib's Hill, or (S.W. part of Bermudas,) from 3 to 5 leagues distant: with various depths we struck ground upon

* But see, in the next section, some remarks on Rocks supposed to exist at about 100 leagues to the eastward of the Bermudas.—Ed.

it in from 17 to 45 fathoms, and several of Admiral Murray's squadron grounded upon it.*

Admiral Murray's Anchorage lies on the S.W. side of Catherine Point, extending from Tobacco Bay to the Ferry, between St. George's and the Great Bermudas: whence, after going through a passage to the westward, there is secure anchorage from abreast of Brackish Pond, across the entry of the Great Sound, as far as Ireland. The common entry into Murray's Anchorage is through an intricate and narrow passage round Catherine Point: for the particulars of which see the Chart,† as no description can be given here that will be of any use to a stranger. The ground in the entry, as well as all over the anchorage, consists of stone, of the soft dripstone kind, ground as fine as flour, mixed with a shelly substance, and a chalky clay: it is very heavy, therefore the anchors do not sink deep in it, and they loosen immediately when a-peak: but it is rare that ships drive in it. I have, in the Resolution, a 74-gun ship, rid many heavy gales in this anchorage, but never started an anchor; although, in Hampton Road, Virginia, which has remarkably tough ground, the anchor has often come home. Ships bound for Murray's Anchorage will generally get a pilot off Castle Harbour, or they may run as far as St. David's Head. When to the eastward of St. David's Head, stand no farther to the northward than to bring the Head N.E., or you will see a white sandy bay to the southward of the Head, between it and Castle Harbour. In standing to the northward, care must be taken to shut no part of this bay in behind St. David's Head. The west land of Bermudas will be shut in behind the land, over this bay, before this mark comes on. In the night, when waiting here for a pilot, the best precaution is the lead; for, if care be taken, and the ship is not running too fast through the water, you will be sure of striking ground in time to avoid danger. There is another passage past the North Rock into Murray's Anchorage, and frigates have gone out through this passage, but I am not acquainted with it. This passage being nearly in an opposite direction to that round Catharine Point, the wind will be fair in it when it is foul in the other, and *vice versa*.

THE FOLLOWING INSTRUCTIONS, for sailing to BERMUDAS' ISLANDS, are those issued by Admiral Murray, when on this station, to ships bound from Virginia and the Carolinas.

"Within the Gulf-Stream steer well to the southward, perhaps as much as S.S.E. until you get within 3 or 4 miles of the latitude of Cape Hatteras; and then steer S.E. by E. until you get into the latitude of $32^{\circ} 5'$. Thus you will avoid crossing the Gulf-Stream where it is very broad, and its direction far to the eastward, and pass it where it affects your latitude more than your longitude; and, of course, be of less consequence to the ship's reckoning: and, by steering thence so far to the southward as S.E. by E., you will fall into the latitude of Bermudas, at 4 or 5 degrees of longitude to the westward.

"You should by no means run for these islands unless sure of your latitude; and always make them from the S.W. if possible, looking out in time for the land: as, owing to the set of the Gulf-Stream, and the general tendency of the currents to the eastward, ships from the coast of America will almost always be far a-head of their reckoning.

"Having ascertained your latitude, and being well to the westward, get into the parallel of $32^{\circ} 5'$, and steer due East: this course will bring you to the islands, passing about 4 miles clear of the south end of *Chub-heads*; a very dangerous shoal, lying across the west end, about 8 miles from the land, with not more than 12 feet on it at low water, as well as the S.W. breakers, which lie about one mile and a half S.S.W. from the southernmost land, being the shoalest part of a ledge of rocks, of considerable length, lying parallel with the shore. Should the wind, in the night, incline to the northward, keep in $32^{\circ} 7' N.$; but, if to the southward, in $32^{\circ} 2'$.

"The soundings do not extend more than a mile and a half from the shore on the south side; therefore you have only a strict look-out to depend on for safety: and, as for the East, West, and North, sides, the breakers lie from 3 to 4 and 5 leagues off. You

* Mr. Owen, of Jamaica, mentioned to me, among the last times I had the pleasure of seeing him, that a bank of 18 or 20 fathoms water had been discovered by some of his Majesty's ships between Bermudas and the Bahamas, but Mr. O. had not obtained any particulars of its position.—A. L.

† Chart of the Isles of Bermudas, published by Mr. Laurie.

must avoid, by all means, running in the night, without having a good observation the preceding day, and being pretty sure of your longitude. Follow these directions, and you will first make Wreck Hill, (which is high land on the western extreme of the islands,) and the land trenching from it to the S.E. Having passed the S.W. breakers, the land lies about E.N.E. and W.S.W., having danger no more than half a mile off, and that generally visible: you may run safely along shore at a mile, until you pass Castle Harbour, which is easily known by the castle on an island on the starboard hand. You should bring-to off the eastern point of this harbour, and wait for a pilot, who will soon come off, and carry you into St. George's Harbour. But, should you be pressed for time, or the pilot not come off, you may haul round by the breakers, after having passed the islands which form the south part of Castle Harbour, into St. George's Road, bringing on the following marks:

"A high island, next to the N.E. part of the small ones off Castle Harbour, has, at its eastern extreme, a bluff rocky point, called St. David's Head, having breakers off it about half a mile: the northernmost land in sight, after you haul round St. David's Head, is called St. Catharine's Point: bring this point to bear W.N.W., and St. David's Head S. $\frac{1}{2}$ W., and you will be in as good a berth as any in the road, with 7 or 8 fathoms of water; but, in every part of these roads, you must be guided by the eye where to drop your anchor clear of foul ground, which is every where easily seen, owing to the clearness of the water and the whiteness of the sand where the anchorage is safe.

"In case you have been driven to the eastward of the islands, (a situation, however, which you are to avoid with the utmost care,) you may run for them in latitude $32^{\circ} 14'$ N., which will bring you to them 5 or 6 miles to the southward of St. David's Head, for which you may haul up upon making the land; but you are not to run in till you are far enough to the S.W. to follow the directions before given for coming from the westward, should you make sail for Bermudas from any part of the Gulf-Stream, or without it.

"I recommend to you to make great allowance for your being to the eastward of your reckoning, and try to fall into the parallel of latitude above mentioned, in longitude 70° or 71° W.

St. George's Latitude is	$32^{\circ} 22'$	Longitude $64^{\circ} 33'$ W.
Wreck Hill	$32 \ 15\frac{1}{2}$	 $64 \ 47$
S.W. Breakers	$32 \ 10$	 $64 \ 45$
Variation 3° W.		

"High water at St. George's, full and change, $8\frac{1}{4}$ hours. Spring tides rise about 6 feet, common 4 feet.

"The tides are various, both in height and time, at different parts of the islands. The Bermudas bear from Cape Henry S. $63^{\circ} 35'$ E. distant 211 leagues."

Directions for Sailing near the BERMUDAS, on coming from the Westward.

"On coming from the westward, the S.W. points of the land ought to bear E.N.E. before you come within four leagues of the land, when you may steer directly for it without danger. The breakers, on the south side, always show themselves; so that a ship may safely approach within gun-shot from the S.W. end to the S.E., and, when getting to the eastward of the castle, round into St. George's. Do not go farther to the northward than to keep Cooper's Island open within St. David's Head till you take a pilot; and the subscriber engages no ship will ever strike, if this be attended to.

(Signed)

THOMAS LEAN."

Jan. 6, 1808.

9. THE COASTS AND ISLANDS OF AMERICA, IN GENERAL.

For a complete and correct description of the Coasts of Newfoundland, of the Gulf and River of St. Lawrence, the Coast of Nova Scotia, &c., to Cape Cod, the reader is referred to the new Edition of the particular Directions for those Coasts, published by the proprietor of the present work. The navigation thence to the southward, including

the whole of the West-Indies and Gulf of Mexico is described in *THE COLOMBIAN NAVIGATOR*, already noticed, and some additional information may be found in the *New Directory for the Windward and Gulf Passages*, lately published.

"As these have been lately revised, the Editor has little to add to the instructions already given. The American navigation, in general, requires details so minute, and explanations so copious, as to render it impracticable to do justice to the subject in an abridgment; and he does not pretend to attempt it, being convinced that it would not answer the desired purpose.

The general explanation of the passages over the Atlantic, to America and the West-Indies, as given in the preceding part of this work, show how these passages are controlled by the prevailing winds and currents; and how the general courses should be regulated in the different seasons. All, therefore, that we have now to add is, the situation of the dangers to be avoided in making those passages; and this will be found attempted in the following section.

SECTION IV.

DESCRIPTION of the ROCKS, SHOALS, and VIGIAS,* in the ATLANTIC; and of the Authorities on which they have been inserted in the Chart.

1. TO THE NORTHWARD OF LATITUDE 50 DEGREES.

NUN ROCK, off Cape Rath, in This rock, with the adjacent bank, was surveyed, under an Admiralty order, by Captain Ramage, in the Cherokee, sloop of war, 1817. According to Captain R., from the centre of the rock, over which there is but 15 feet of water, at low ebbs, Cape Rath bears, (by compass,) S. 32° W., nearly 15 miles; Farout Head, S. 10° W., 18 miles; Whiten Head, S. 6° E., 21½ miles; the Stack, S. 35° E., 14 miles. For a farther description of the rock and bank, see our Memoir on the Northern Ocean, page 14.

AITKIN'S ROCK, to the West of the N.W. of Ireland. The original notice, relative to this danger, was published at Whitehaven, 12th September, 1740, and is as follows: On the 16th of July last, at seven o'clock at night, in our passage from Virginia, on board the Friendship, of Ayr, John Aitkin master, James Lockhart mate, coming in at the N.W. channel of Ireland, going under reefed-foresail, wind at N.N.W., steering E. by S., saw, by the weather-leech of our foresail, a rock under water, about 4 feet, distant 40 or 50 yards, to the best of our judgment, our ship running 6 knots by log, with a heavy swell from the N.W.; all hands being on deck saw it plainly: next morning made the land, betwixt Insterhul and Tory Island, at about eight o'clock; and, at twelve, made the mouth of Derry-loch, bearing S.W. by S. distant 10 leagues; Ilav bearing E. by S., distant 6 leagues; and, by making these lands next morning, I find the rock lies in the latitude of 55° 18' N., and longitude, from the meridian of London, 11° 14' W. It lies from Island Tory West, distant 94 miles, without allowance of variation. At the time we saw the rock, it was an hour's ebb. Island Tory is falsely laid down in the books: instead of 55° 8' N. latitude, it should be laid down in 55° 20' N.†

A second advertisement, relative to this rock, was published by Mr. F. Cumming, of New York, in the year 1793. It states that, "as doubts remain with many naviga-

* VIGIA is a Spanish word, literally signifying *Watch*, or *Look-out*. It is, generally, in the charts, attached to spots supposed to be dangerous, and which should, therefore, be approached with caution.

† Captain Huddart places Tory Island in lat. 55° 17½'. See pages 6 and 8.

tors respecting the existence of Aitkin's Rock, to the westward of Tory, I think it a duty to make public the following information relative to it, communicated to me by the Rev. John Stewart, a passenger with me in the *Enterprise*, from New York to Greenock, on Thursday, August 9th, 1792.

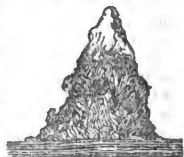
"Ship *Nestor*, of Greenock, from New York, bound to Greenock, being in latitude, per observation, of $55^{\circ} 19' N.$, and longitude, per account, of $9^{\circ} 53' W.$ of London. The officers, passengers, and ship's company, who were then on deck, perceived a rock about four feet below the surface of the water, not five fathoms from the weather-beam of the ship, in the form of a horse-shoe, with one side longer than the other; the mate instantly threw an empty barrel overboard; the yawl was got out as soon as possible, and the mate, four hands, and two passengers, went in the boat, and were absent near two hours in search of the rock; but, owing to the ship's drift, and a dark cloud which then obscured the atmosphere, they could find neither rock nor barrel. Mr. Stewart was then a passenger in the *Nestor*, and saw the rock plainly, with the tangle growing on it.

"FORTESCUE CUMMING, Master of the Ship *Enterprise*, of New York."

We have other accounts of this rock; and of these one states its position as $55^{\circ} 15' N.$ and $11^{\circ} 40' W.$; a part appearing 3 feet out of the water, with soundings of 30 to 40 feet at a short distance: at 30 fathoms off no soundings with a line of 150 fathoms. In or about the year 1804, Captain Clarke, since of the *Harmony*, of Ayr, saw the rock very distinctly: by his run it appeared to lie 20 leagues nearly true west from Tory Island. He thinks it is from one half to a whole cable's length long, and about 150 feet broad. The tangle appeared at about one foot below the surface, at about dead low water, and the ship rubbed alongside the rock. Captain C. is of opinion that the rock may be several miles North of the parallel of Tory. We have further accounts of Aitkins' Rock, which do not require repetition. It is really lamentable that the most satisfactory information on this danger, *or dangers*, has not yet been given to the world.

BRASIL ROCK, in lat. $51^{\circ} 10'$, and long. 16° . M. Bellin, in his Memoir of 1742, states, that this rock is marked in latitude 51° , and longitude $19^{\circ} 30'$ from Paris, according to Brouage, hydrographer, and Laisne, a pilot. It has been variously represented in different charts, although its existence has been doubted. Messrs. Verdun and Borda have added to their remarks upon this rock, that they do not believe it to exist. It was, however, seen in the year 1791, by the company and master of an English merchant-ship, the commander of which favoured the editor of the present work with a description of it, stating that it is really a high rock, or islet, apparently bold-to, and to which he passed so near, that he could have cast a biscuit on shore. The longitude, according to his computation, was about $16^{\circ} W.$, but we suspect that it is rather more to the westward.

ROKOL, or Rockall, in lat. $57^{\circ} 39' 32''$, long. $13^{\circ} 31' 16''$. This is a large and high rock, of a conical or sugar-loaf shape, the summit, or upper part, of which is perfectly white, from an immense quantity of birds' dung, with which it is covered. The rock has been seen many times, but its true situation was unknown till the year 1810, when it was ascertained by Mr. T. Harvey, master, and the other officers of the *Endymion*, frigate, commanded by the Hon. T. B. Capel. By the observations made by these gentlemen, on the 8th July, it appeared that the longitude, per mean of 11 lunars, was $13^{\circ} 30' W.$, and the latitude, per meridian altitude, $57^{\circ} 40' 10''$. On the 8th August, the longitude, per mean of three chronometers, appeared to be $15^{\circ} 29' 30''$; by mean of 5 lunars, $13^{\circ} 34' 19''$; and the latitude, per meridian altitude, $57^{\circ} 38' 54''$. Hence the mean latitude and longitude is assumed as $57^{\circ} 39' 32''$, and $13^{\circ} 31' 16''$.



Appearance of Rokol, 2 miles distant, as taken by Mr. Harvey.

With the rock bearing N. by W., broken water appeared about a mile to the N.E. of it; and, on approaching nearer, a rock, on which the water broke, appeared just at the water's edge. When due South of Rokol, the breakers were in a line with the eastern part of it. The variation of the compass, according to observations now taken, was $33^{\circ} 35\frac{1}{2}' W.$

The following remarks on Rokol were communicated to the public by Mr. Richard Peacock, in 1809. "This rock appears almost like a ship at a distance, and is steep

close-to on the north side. I have passed at the distance of about 50 fathoms; but, to the southward, or nearly S.E. by E. from the rock, there lies a long reef of rocks for about 3 miles. On this reef, with gales of wind, the sea breaks very heavily.

"Captain Osborn, of Workington, told me that, on his passage from Quebec, in 1806, it was with the utmost difficulty he escaped getting amongst the breakers. Captain Magee, of Greenock, also informed me, that he had seen the sea break to the distance of nearly three miles in a S.E. direction from the rock."

Helen's Reef, to the N.E. of Rokol.—On a reef, until then unknown, and lying about two leagues, or less, E.N.E. $\frac{1}{2}$ E. (by compass,) from Rokol, the brigantine *Helen*, of and from Dundee, struck fatally, on the 19th of April, 1824. This vessel, commanded by Mr. Thos. Erskine, was bound to Quebec and Montreal, with a general cargo, and after she had struck, the crew and passengers continued at the pumps for 13 hours; but, being overcome with fatigue, were at length compelled to abandon the vessel, as the leak was rapidly gaining on them, the water being within three feet of the hold beams. When lowering the long-boat she unfortunately was stove in pieces against the vessel, with a tremendous sea. The crew, at that period 12 in number, embarked in two boats, with one passenger, and soon after they had left the vessel she sunk, when sixteen passengers perished, of whom seven were women and six children. The crew were picked up at sea by the bark *Flora*, Capt. Baker, from Dantzic to Liverpool, and safely landed on the Isle of Tiree, one of the Hebrides.

It appears, from Capt. Erskine's narrative, that he estimated Rokol to lie in $13^{\circ} 40' W.$ That the vessel struck twice on a clump of rocks, apparently not much bigger than a ship's length, and on which the sea broke occasionally. No other breakers were in sight at the time. Rokol at this time bore, by compass, W.S.W. $\frac{1}{4}$ W., he thinks about 6 miles distant; but, as the weather was hazy, probably something less.

Another intelligent person has related that he had, about two years before, fallen in with the breakers to the S.E. of Rokol, which appeared to extend outward 3 or 4 miles, in clumps at some distance from each other. Would that the officers of the *Endymion* had made a more particular examination of the surrounding dangers.

LION'S BANK, in lat. $56^{\circ} 40'$, and long. $17^{\circ} 45'$. This bank was sounded by Lieutenant Richard Pickersgill, in the brig *Lion*, in 1776, who found upon it from 290 to 320 fathoms. A vast quantity of sea-fowls were over it, and it probably abounds with fish. The position annexed is that given in the Requisite Tables. Dr. Forster, in his *History of Voyages* made in the North, says, "On the 29th of June, with 320 and 290 fathoms, Pickersgill found a sandy bottom, in $56^{\circ} 38' N.$, and $17^{\circ} 44' W.$, which induced him to call that spot the *Lion's Bank*; and particularly so, as he found there, what is usually seen on all banks at sea, a vast quantity of sea-fowl, such as gulls, dumdivers, &c. Soon after this, he could no longer get any soundings, nor were there any more fowls to be seen.

KRAMER'S BANK, in about $60^{\circ} 57' N.$, and $16^{\circ} 40' W.$ This Bank appeared in M. Bellin's Chart, of 1751, and was probably copied from the Dutch charts of the Greenland Seas, which represented it as of considerable extent. It is said to have been discovered by Captain *Alof Kramer*, but whether dangerous or otherwise we know not. Captain Ross sought for this bank, but unsuccessfully, in 1818. This gentleman says, "Continuing our course, we came, on the 8th of May, to the spot where a bank is laid down in *Steel's Chart*, as discovered by *Alof Kramer*, but we could find no soundings in 130 fathoms, any where on or near the place."

We are not quite satisfied that *Kramer's Bank* does not exist, although not exactly in the situation assigned to it by *Steel's Chart*, which is, in fact, a republication of a very old Dutch chart. From the track of the *Isabella*, it seems probable that she may have passed to the southward of it.

LAND OF BUS.—M. Bellin's chart of 1751, represents an imaginary island, called the *Land of Bus*, to the southward of Iceland, about the latitude $58^{\circ} 2'$, and longitude $29^{\circ} 55'$. It again appeared on the chart of 1768, at 10 minutes more to the East. This, on the old charts of Van Keulen, is the situation of the western part of a coast which occupies many leagues of extent, with an inscription, of which the following is a translation:—"The Land of Bus has been overflowed, and is not at present more than a league round, when the sea is high. There was, many years ago, a large island, named *Frise-land*,

land, here, which was full 100 leagues in circumference, on which were many villages." This land is really represented as a large island on several charts of the Atlas of Mercator, of the Arcano del Mare, in Bleau's and other more antient charts, with particulars of towns, villages, &c., which might tend to persuade us that it formerly existed. Whether it ever existed or not, we are certain that it exists no more. The ship *La Flore*, in the voyage of Messrs. Verdun, Borda, and Pingré, passed over the place where it is exhibited on the old charts, and never perceived the smallest trace of it. To this we shall add, that Anderson, in his History of Iceland, Greenland, &c. says, that a very expert captain of a ship did his utmost to discover the supposed remains of this island, and purposely employed two months in cruising on all sides, within 50 leagues round: he discovered no trace of land, but in every part a depth of 100 fathoms. The sea was agitated to that degree, that its waters were always higher there than any where else; they were greenish, and filled with a prodigious quantity of marine substances. Mr. Anderson is of opinion, that there were sources of hot water at the bottom of the sea in this place.

For Captain Ross's Remarks on this imaginary shoal, see our Memoir on the Northern Ocean, page 124.

VIGIA, in lat. $55^{\circ} 24'$, In the French chart of the Northern Ocean, of 1751, in and long. $24^{\circ} 40'$, latitude $55^{\circ} 24'$, and long. $24^{\circ} 40'$, is represented a rock, high above water, with these words—"Rock, 1746." No account of this rock can, however, be traced in any English or Dutch chart. We have given it the same position as that assigned to it by Bellin, but consider its existence as very doubtful.*

N.E. LEDGE OF BELLE ISLE.—Captain Cook, in his directions, which accompany the North-American Pilot, has observed, "that ships steering for this island should be careful to avoid a ledge of rocks that bears N.E. $\frac{1}{2}$ N. [*about N. by E.*] from the east point of the island, distant 2 miles. Part of these rocks appear above water, and the sea always breaks upon them. You will have 20 fathoms close to them, and 56 between them and the island. All about this island are irregular soundings; but you will not find less than 20 fathoms home to the island, excepting on a small bank, lying N.W. by N. 4 miles from the N.E. end, whereon it is said are only 5 fathoms." Upon these rocks, &c. the icebergs are frequently aground, and completely obstruct the navigation of the Strait.

BETWEEN THE LATITUDES OF 40 AND 50 DEGREES.

ROCHE BONNE and the Bancs Vertes, in the Bay of Biscay. These are two reefs, lying within a short distance of each other, East of the Isle of Re. Their position will be found already noticed, in the description of the coasts, &c., page 146.

The CHAPELLE BANK. In the Analysis of the French chart of the Atlantic, of 1786, it was remarked that a rock, denominated *La Chapelle*, on the chart of 1766, in latitude $47^{\circ} 24'$, and longitude $7^{\circ} 12'$, was said to have been seen in 1764. It was previously represented, on the old Chart of M. Vankeulen, in latitude $48^{\circ} 15'$, 38 leagues from Ushant; and the only authority appeared to be a memorandum found in the Dépôt Marine, at Paris, stating that, at four in the evening of Shrove-Tuesday, 1695, the Sieur Chapelle Richard saw a rock within pistol-shot, at 36 leagues from Ushant, in the latitude of the Penmarks. It appeared fifteen feet above the water. He caused the part he was in to be sounded, without finding bottom at 130 fathoms. No information respecting it has since been found, although very particular researches have been made; and it has been given up as imaginary.

But, on the 27th of September, 1822, as the sloop *Favorite* was returning from Malaga towards Liverpool, at day-light, the water appeared green, as if on soundings; at 10 a.m. the water seemed greener, also at noon, when the latitude observed was $47^{\circ} 26' 1''$, and the longitude, by account, from last lunar, $7^{\circ} 41' 9''$.

* This, with numerous other paragraphs of the present section, is from the Relation of the Voyage of *La Flore*, Messrs. Verdun, Borda, and Pingré, 1774.

" 28th of September. If we are on soundings, which the water seems to denote, by still getting greener, we must have been on them in the morning, in about $7^{\circ} 24' W.$ longitude, as the watch on deck noticed the colour of the water, so soon as day-light broke. I came on deck, says Captain Livingston, soon after, and immediately remarked it; and the next watch, on coming on deck at 8 a.m. also remarked it. All of us, without its being pointed out, and we have three tolerable navigators, (experienced seamen,) besides myself, on board. At 4 p. m., water much discoloured, and a heavy sea. About 7 p. m., wind abating, and a very cross sea, and one place, in particular, broke, as if on bottom of no great depth. At 7h. 27m., latitude, by meridian altitude of the star Altair, a good observation, $47^{\circ} 36' 56''$. By 7h. 30m. water suddenly quitesmooth, as if under the lee of land. At 8, the temperature of the water was remarkably decreasing, and, fearing (however unlikely) that we were near the coast of France, prepared to clear all danger. At 8 p. m., sounded, and got rocky bottom in 65 fathoms: the arming of the lead bringing up a bit of shell and three small black specks. At $8^{\circ} 21'$ again sounded, in the same depth of water, 65 fathoms, and rocky bottom; but this time the arming had only two small specks and a very minute one; made sail, and kept away to clear the land. At midnight, sounded: no bottom at 80 fathoms. At 6 a. m., no appearance of land; hauled up: day-light increasing, perceive the water is less discoloured; and by noon the water is quite blue again.

" At noon, latitude, by account, $47^{\circ} 49' 38''$, observed, $47^{\circ} 49' 49''$. Longitude, by account, from last lunars, $9^{\circ} 15' 59''$, at noon this day.

" If we have really passed over a bank, it must extend, in longitude, from about $7^{\circ} 24'$ to $8^{\circ} 29'$ west of Greenwich: I am aware, however, that this can be considered as a rough guess only; and, from the thermometer, it seems highly probable that some places on the bank are much shoaler than others. At all events, the latitude, in which we got soundings in 65 fathoms, may fairly and surely be taken at about $47^{\circ} 37' 12''$, being nearly the meridian latitude, found by meridian altitudes of $\star$ Altair, (α Aquila,) and the ζ , at mean of the times of the two observations, viz. at 8h. 30m., when we could hardly have the line hauled in, after the second soundings. Variation allowed on the preceding day's work, about $26\frac{1}{2} W.$

" The *Chapelle Bank*, as we may call it, will, at any rate, be found in latitude $47^{\circ} 37'$ somewhere between the meridians of $7^{\circ} 24'$ and $8^{\circ} 29'$. I have not calculated back for its position from the lunar of the 30th, because I am convinced Rennell's Current subsequently gave us westing, equal to all we made, or nearly so, on the edge of Channel soundings. I hope that some person, who has time and good chronometers, will ascertain the true position of the bank, now I have undoubtedly ascertained it to exist."

DEVIL'S ROCKS, in lat. $46^{\circ} 35'$, M. Bellin, in his Memoir of 1742, noticed that, and long. $13^{\circ} 7'$ in latitude $46^{\circ} 55'$, about 110 leagues W.S.W. of

Ushant, there is a rock even with the surface of the water, discovered by Captain Brignon, of the *Constance*, of St. Malo, in 1737. It appears to be the same as that marked in a manuscript chart of M. Redouay, which is nearly in the same latitude, and with the same bearing and distance from Ushant. The Devil's Rocks, in lat. $46^{\circ} 35'$, and long. $13^{\circ} 10'$, according to M. Delisle, may be the same danger. These have been marked on many charts. They were particularly observed in 1764, by Captain Thomas, a respectable and intelligent navigator of Havre de Grace, from whose written communication, addressed to M. L'Abbe Diquemare, we find that, on the 23d of May, 1764, Captain Thomas observed at noon the latitude $46^{\circ} 24'$. The danger was discovered at the same moment, off the larboard bow, at a short distance, three feet above water, of a grey colour, covered with moss, and about 40 feet in diameter. We formerly placed it, upon this authority, in latitude $46^{\circ} 24'$; estimating the longitude at about $13^{\circ} 10'$.

In a Liverpool Advertiser of the 5th of July, 1819, a note on these rocks was given as follows: "The Brothock, of Arbroth, Captain William Peter, on a voyage from this port to Rio Janeiro, on the 13th of November, [1818,] running with a fresh breeze from the N. N.E., at noon, observed a rock about ten feet from the starboard quarter, about two feet under the surface of the water, in latitude $46^{\circ} 35' N.$, and the longitude, by mean of two well-regulated chronometers, $13^{\circ} 7' W.$ The water recoiled around it, and broke on the top. Its circumference appeared to be about forty feet. The above rock agrees in latitude with the Devil's Rocks, laid down in some charts, which have been so long doubtful: its longitude differs a few miles only."

NEGRE'S ROCKS, lat. $48^{\circ} 7'$, On the French chart of 1766, a danger is exhibited long. $21^{\circ} 0'$. in $47^{\circ} 42' N.$, and $20^{\circ} 40' W.$, which appears to be one noticed by M. Bellin, in his Memoir of 1742, and of which he said, "A danger, in latitude $48^{\circ} 8'$, and longitude $20^{\circ} 38'$, was seen the 24th of June, 1722, by Charles Negres, commander of La Rose St. Croix, of Martinique. It appears to be one which was likewise seen by Joachim Bouve, near which he sounded, and found bottom at 80 fathoms. When seen on the 24th June, it appeared divided into two parts, situated north and south. On the southern part were three points of rocks, in form of a sugar-loaf, in latitude $48^{\circ} 7'$; but with a difference on the foregoing longitude of $43'$. It is seen that there is also some difference as to latitude. We have adopted that which accords with the relation of C. Negres, and have also placed it in longitude $21^{\circ} 0'$, being a mean between the different deductions of the latter and of M. Bellin. These rocks appeared on the English chart of Mr. Jefferys, in latitude $47^{\circ} 50'$, and longitude $20^{\circ} 30'$.

MAYDA, in lat. $46^{\circ} 10'$, This vigia appears on the French chart of 1766, in latitude long. $19^{\circ} 40'$ $46^{\circ} 48'$, and longitude $19^{\circ} 50'$. The latitude, according to Bellin, is uncertain, and its longitude more so. A report made to the Admiralty of Bourdeaux, by Pierre Nau, in October, 1705, states it to be a little white island. There is a note concerning it in the French Depot, but it disagrees with the report of P. Nau. Captain Briden, in the ship Marie, when returning from Martinique, April 10, 1738, having had a good altitude in fine weather, discovered Mayda; which, according to his observation, he found in latitude $46^{\circ} 10'$. He remarked *five heads of rocks*, and a breaker of 6 or 7 feet high on the danger. This report seems to merit more attention than the former; for, if Mayda exists, we should rather expect to find it a danger than an island; for, if the latter, it must surely have been seen by many navigators. We give it as doubtful in latitude $46^{\circ} 10'$, and longitude $19^{\circ} 40'$, according to the report of Captain Briden. It has been placed somewhat differently in several English charts.

The FIVE HEADS, in lat. Under this denomination the French chart of 1766 has a rocky shoal, some part above water, in latitude $44^{\circ} 10'$, and longitude $19^{\circ} 25'$. It is marked some minutes more to the north on the charts of M. Van Keulen. No account of it is, however, given either by him or Bellin: nor, although sought after, has any account of it yet been found. It seems that Bellin, in his charts of 1757 and 1766, has given it on the solitary authority of Van Keulen. The *Five Heads* of Mayda, above described, appear to be one and the same.

ISLE VERTE, or Green Rock, This rock, the '*Green Island*' of the old charts, has been omitted in others, on the authority of Messrs. Verdun and Borda, who have said, "On M. Bellin's chart of 1766, in latitude $44^{\circ} 52'$, and longitude, $26^{\circ} 25'$ is an *imaginary* island, named the Isle Verte or Green Island. In the Memoir of 1742, we find nothing concerning this island, but that the '*Isle Verte* is marked according to *Le Boccage*.' It appears on the English chart of Jefferys, in latitude $44^{\circ} 45'$, and longitude $26^{\circ} 10'$, and is supported by no better authority; we cannot, therefore, believe that it exists. A great number of ships pass every year through this latitude and the adjacent parallels, and a thousand authorities would surely attest its existence were it not *imaginary*."

Notwithstanding all this, Captain Tulloch, of New Hampshire, (already mentioned, page 191,) has stated, that an acquaintance of his, Captain Coombs, of the ship Pallas, of Bath, in the district of Maine, when crossing, or running down, the parallel in which Green Island is laid down in the charts, and keeping a look-out for it, although he had little idea that it really existed, actually saw it, being on a very fine day, and the water remarkably smooth: he went out in his boat, examined it, and found it to be a large rock or stone, covered with green herbage, or moss, *some of which he pulled off*. The rock did not seem much larger than a vessel with the bottom up, and it was very smooth around. The summit was higher than a vessel's bottom would appear out of the water, being about 20 feet high above the sea. Captain Coombs remarked that, if it had not been so high, he should, when he first saw it, have supposed it to be a vessel which had been upset.

Captain Tulloch considers that Captain Coombs, who is now dead, was a man of perfect veracity. It is to be regretted that we have, not yet, the exact position of the rock.

(Communicated by Captain Livingston, 1819.)

GREEVE'S LEDGE, in lat. This is stated to have been seen by the Dutch ship Anna Catherine, Captain J. Greeve, July 7, 1745, and to be nearly level with the sea. It is said to have been seen by Captain Currie, of the brig Diana, of Port Glasgow, in 1811. Captain Livingston says, "I was informed by one of his crew, (John Hagarty, whose veracity I can depend on,) that they saw it very plainly. It was a rock, about two feet above water, and had seaweed growing on it. On being asked if it might not be ice? He replied, 'he was perfectly certain that it was not.' *The position is yet uncertain.*

AMPLIMONT ROCKS, in lat. In M. Bellin's Memoir, of 1742, a danger is mentioned in latitude $42^{\circ} 30'$, and longitude $24^{\circ} 5'$, which was seen in 1735 by M. Guichardi, commander of the ship Dauphin, of Nantes. It has two points of rocks, separated, and 30 feet above water. He ascertained the height within a league of the danger, which appears to be the same as that called *La Basse d'Amplimont*, stated to be nearly in the same latitude and longitude.—We have given it the position originally assigned by the Memoir. Some Englishman has called it by the name of Edmund Knowles's Rock, by whom it is supposed to have been seen.

An intelligent commander of Greenock has informed Captain Livingston that he actually struck on a rock, some years ago, at 9 a.m., near where the Amplimont Reef is exhibited on the charts. It is, however, to be regretted that he made *no note as to the situation of the danger.*

PERSEUS' SHOAL, in lat. This reef was discovered by the ship Perseus, on returning from the East-Indies, in 1813; the sea was nearly calm, and the breakers plainly seen extending about two cables' length N.E. and S.W.

THE THREE CHIMNEYS, in lat. This vigia is said to have been seen on the 10th July, 1720, by Captain de Clas Fernel, who approached within two leagues of it; and who remained two hours in sight of it. This vigia appears to be one which a M. de Merry has mentioned. The charts vary with regard to its position, and its existence may even be considered as very doubtful.

Thus much we have stated in our former editions: but Mr. Heron, of Greenock, in 1824, adds, "I am informed by the master of a merchant-vessel, that the Chimneys actually exist, for a whole watch as well as himself, saw them. They were seen about twilight, and three heads were distinguished. From an observation taken at the preceding noon, it was inferred, that their latitude, as laid down on the chart, is very near the truth.

GOUGH'S ROCKS, in lat. $40^{\circ} 28'$, and long. $33^{\circ} 0'$. These rocks appeared in the chart of M. Rochette, 1778, with the words, "Rocks seen by Captains Gough and Birch;" but we have no further account of them. This reef may possibly be the shoal next described. Vankeulin and Bellin have indicated several dangers in the vicinity to the N.E., but their existence has been denied by the pilots of the Azores.

SHOAL seen in 1769, in lat. $40^{\circ} 26'$, and long. $36^{\circ} 5'$. This has been inserted on the same authority as Gough's Rocks. It is represented as a bank of five fathoms, seen, "in 1769, by a Spanish ship."

RAMIGEAU'S VIGIA, in lat. In the Dépôt Marine of Paris there is a note of a discovery, which states, that "Pierre Ramigeau, captain of Le Lezard, of Rochelle, in coming from Cayenne, saw a danger, on the 1st of October, 1750, at 11, a.m., the weather clear and serene, in latitude $42^{\circ} 42'$, and long. $37^{\circ} 30'$. He kept within sight of it above deck for 30 minutes; it appeared to have two or three fathoms over it; but the weather would not permit him to approach it. He passed within half a mile of the shoal, and observed the latitude being to the south of it." This writing was signed by his officers. We are strongly inclined to suspect, that this shoal of Ramigeau was a body of ice, which had floated down from the northward.

The late Spanish chart exhibits a *vigia*, seen in 1798, about half a degree to the northward of the position assigned to the shoal above described, and nearly on the same meridian. It may, perhaps, be the same. We have shown the assumed position of each on the chart.

BARENTHY'S ROCK, in lat. $45^{\circ} 40'$, and long. $37^{\circ} 25'$. This danger is mentioned in M. Bellin's Memoir of 1742, who states it to be in $45^{\circ} 50'$, and longitude $36^{\circ} 25'$, discovered in March, 1726, by M. Barenthy, commander of the St. Etienne, of St. Jean de Luz, on his passage to Cape Breton. The ship touched upon a rock, a part of which was afterwards found sticking to the keel of his ship. The existence of a danger hereabout is, however, doubted: we have, notwithstanding, assigned it a place as above, differing one degree of longitude from Bellin, who has placed Cape Breton a degree and a quarter too far eastward.

VIGIA, in lat. $44^{\circ} 0'$, and long. $39^{\circ} 20'$. In the French Dépôt Marine there is the following note relative to this *vigia*: "Jean Surgeac, captain of La Marie Rose, of Bordeaux, saw, on the 9th of April, 1750, a sand-bank, in $40^{\circ} 53'$ of latitude, and $35^{\circ} 45'$ of longitude, from Tenerife, in very clear weather. He passed within a quarter of a league of this bank, which appeared to him like a red rock, even with the water, stretching about three leagues N.N.E. and S.S.W., and being a quarter of a league broad;" of which he made his declaration to the Admiralty of Bordeaux. This is supposed to be the same with a rock, discovered in 1687, by a pilot named Albert, on his passage to Quebec, at several degrees to the eastward. The existence of either is questionable.

JAQUET ISLAND, in lat. $46^{\circ} 55'$, and long. $39^{\circ} 30'$. The existence of this island has been so much doubted, that it has been omitted in several modern charts: but, having been stated to have been seen in 1789, it has been restored. We possess no description of it; and are not free from the suspicion that islands of ice, in the vicinity of the position assumed as above, may have been mistaken for land.

SHOAL discovered in 1803, lat. $41^{\circ} 24'$, and long. $41^{\circ} 20'$. This shoal has been inserted from the late Spanish chart; but we are not acquainted with the authority under which it has been there introduced. It may possibly be a rock, said to be seen by Desmaries, a pilot, in 1683, who reported that it appeared at the height of a sloop above the water. Bellin assigned to this danger lat. $42^{\circ} 0'$, and long. $41^{\circ} 10'$. The Spanish chart also exhibits another *vigia*, said to have been seen in 1798, lat. $43^{\circ} 30'$, long. $37^{\circ} 35'$. Most likely to be of ice only.

SHOAL seen in 1798 and 1803, lat. $40^{\circ} 22'$, and long. $42^{\circ} 40'$. This has also been introduced from the Spanish chart, which states only, "Vigia seen in 1798 and 1803.—The same chart has another, in $39^{\circ} 40'$ N. and $41^{\circ} 35'$ W., said to have been seen in 1816.

HERVAGAULT'S BREAKERS, in lat. $41^{\circ} 0'$, and long. $48^{\circ} 50'$. We have shown the situation of these breakers on the chart, although it is the opinion of many experienced navigators that no danger exists here; and that masses of ice, seen in these places, have been mistaken for rocks. They were inserted originally upon the authority of M. Hervagault, commander of Le Conquerant, of Nantes, 26th of June, 1723; who described them as composed of two parts, between which he was forced to pass; being, when he first perceived them, at a cable's length from the one, and not more than an eighth of a league from the other. The sea between was very clear, and broke heavily upon the dangers. In a manuscript at the French Dépôt Marine, there are these additional particulars: "The shoal, within a cable's length of which he passed, is a rock, which showed itself after the sea had broken upon it. On the other danger the sea broke in three different places, and between each it appeared very clear."

DARAITH'S ROCKS, in lat. $40^{\circ} 50'$, and long. $54^{\circ} 53'$. The same opinion is entertained of this as of Hervagault's breakers. M. Bellin, however, placed it as a certain danger; and, in his Memoir of 1742, has said that, this danger was seen on the 22d of August, 1700, by M. Daraith, who approached within a league and a half of it, then sailed around it, in order to observe it well, and took an altitude within sight of it. The rock is described as extending a league and a half, being three-quarters of a league broad. Its longitude is very uncertain.

WATSON'S ROCK. lat. Extract of a letter from Capt. T. A. Watson, dated 4th 18', and long 53° 40'. Liverpool, 22d of July, 1824.

"Perhaps you may have seen, in some of the newspapers, a notice respecting a rock seen by me in April last, on my passage from this port (Liverpool) to St. John's, N. B. The following are the particulars:—April 20th, at 8, *a. m.* being on the starboard tack, ship going 2½ knots an hour, moderate weather, a man saw something a-head: the helm was immediately ordered a weather to clear it, being very near it, ship was only 15 or 20 fathoms to leeward of it, which enabled me to distinctly make it out to be a rock just even with the water; its head was round, and appeared to be about three fathoms or more in diameter, it was covered with weed, similar to that on half-tide rocks, it was of a light green, with some branches of a red colour. It was at times on the top of a sea, invisible; but in the hollow of a sea, several feet uncovered. I observed the sea to break on it twice, causing a spray, as any pinnacle like substance, with deep water around it, might be expected to do. My first officer and others also saw it, and are fully convinced of its being a danger; the lead was hove as soon as it could be got forward, but there was no bottom at 90 fathoms perpendicular. I might then be within musket-shot of it, from the mast-head; no appearance of other danger could be seen.

"From an excellent observation at noon, I consider it to lay in latitude 40° 18' N. longitude, by dead reckoning, 53° 40' W.

"The water for several miles around it was dark, as if on soundings. Fearing I might strike on some invisible danger, I did not put the ship's head towards it, and there was too much sea to lower a boat; recovering from the consternation this unexpected sight put me into, I left it astern, fearing there might be more beneath the surface, directly in the tract I was going.

"From my thermometrical observations on approaching to, and on the great Bank of Newfoundland, I have reason to think the above longitude nearly correct; at least, if any error, it could only be a few miles too far eastward. I unfortunately broke this *most valuable* instrument a short time before seeing the above danger.

"I understand there have been many opinions as to the truth of my statement; it is difficult to convince some, and perhaps, if the Harbinger, which I commanded, had struck on it, some would have supposed, she had alighted on the back of a whale, though, by the bye, weeds are seldom seen growing there.

"During the many years (14) I have commanded a ship, mostly in the North American trade, I have seen various things in the ocean, and was too well acquainted to mistrust my eyes in this case. It is said that Daraith saw a danger not far from this, perhaps it may be a part of the same, as he represented it as very extensive: I am convinced, we too often treat *doubtful dangers* in charts with indifference, because they are not always seen by those who look for them; may it not be the case, that ships sometimes are wrecked on them and never heard of! However, I shall always dread the above danger when sailing in that part of the ocean."

The VIRGIN ROCKS, to the These rocks form a dangerous reef, lying about 18 E. by S. of Cape Race. leagues E. by S. true, from Cape Race. They are said to extend in a true N.E. by E. direction, four miles; in gales of wind a heavy sea breaks over them; and a strong current which sets about them, often increases the danger.

The existence of the Virgin Rocks having been questioned, it may not be improper to communicate the following extract of a letter, addressed by Arthur Kemp, master of the brig, *Indiana*, of Dartmouth, to the publisher of the *Newfoundland Gazette*:—"On the 23d of October, 1823, at noon, I left Cape Broyle, after a strong gale from S.E. with the wind at W.N.W., steering S.E. by S. The following morning at 8, *a. m.* having run 84 miles, I was alarmed with the cry of "*breakers a-head*," and almost immediately saw them to such an alarming extent, as obliged me to alter the course from S.E. by S. to E. by N., it not being possible to clear them on the other tack. After giving the breakers a good berth, and leaving them to the southward, distant four miles, I hove the main-topsail to the mast, and lay by from 10 o'clock till noon, and observed in latitude 46° 35', longitude 50° 51'; the extent of breakers appeared to be about two miles, and were more tremendously alarming than I have ever experienced, during twenty-three years that I have (chiefly in this trade) commanded a vessel."

CASHE'S LEDGE, in lat. This is a dangerous reef, about half a mile in extent $43^{\circ} 1'$, and long. $69^{\circ} 9'$. each way. Its soundings are very irregular, having from 10 to 4 fathoms in the length of a boat. There are 17 fathoms within a cable's length of it, deepening at a short distance to 90 fathoms; on the western side. On approaching the shoal, you may find 60 to 35 fathoms, brown sand, with black stones and broken shells; then 30 fathoms where it becomes rocky. The currents on the ledge are exceedingly rapid and devious. On the shoalest part there are said to be only 12 feet at low water. By observations made, on four successive days, by the master of his Majesty's sloop *Beaver*, the latitude is $43^{\circ} 1' 0''$. The longitude has been deduced from that of Cape Anne as from $69^{\circ} 6'$ to $69^{\circ} 12'$. For a further description, see our Book of Directions for Newfoundland, &c., page 105.

SHOAL GROUNDS ON George's Bank. These shoals were formerly described under the respective names of *Brown's Bank* and the *Malabar Shoal*, by neither of which names are they now recognized. A copy of the report of an actual Survey of them, made under the orders of Commodore Isaac Hull, by Mr. Felch, of the U. S. Navy, and Mr. Edmund Blunt, jun., is contained in the *Colombian Navigator*, Vol I. page 34. From this report it appears that there are, properly, four shoals on the Bank, the whole of them included between latitudes $41^{\circ} 34' N.$ and $41^{\circ} 53' 30'' N.$, and longitude $67^{\circ} 18' W.$ and $67^{\circ} 59' W.$ The largest, which is towards the S. W. is, also, the most dangerous. Between the shoals are from 15 to 35 fathoms of water.

NANTUCKET SHOALS, extending from Nantucket Island. These very dangerous shoals have been represented as extending nearly half a degree to the southward from the S. E. end of Nantucket Island: but it has been found, by a late survey, made at the expense of Mr. E. M. Blunt, of New York, that they are, by no means so extensive as they have heretofore been represented; and that the southern extremity, with 9 fathoms of water, is in about $40^{\circ} 57' N.$, and $69^{\circ} 58' W.$ For farther particulars, see *Colombian Navigator*, Vol I, page 51.

BETWEEN THE LATITUDES OF 30 AND 40 DEGREES.

DÆDALUS ROCK, off Cape St. Vincent. The old charts of the Atlantic indicated a danger at the distance of 12 or 15 leagues to the S.W. of Cape St. Vincent. This danger was omitted in the French chart of 1786, and subsequently in other charts, from the supposition that, if it really existed, it must have received some modern confirmation. But it seems, from information communicated by Captain Taylor, of the Brig *Laurel*, of Whitby, that, about six years since, the *Dædalus*, transport, struck on the rock, and received so much damage, as rendered it necessary for her to put into Lisbon for repairs.—Captain Taylor was in the fleet when the *Dædalus* struck.

Added to this, the brig *Briton*, Captain Stokes, was lost, in consequence of striking upon the rock, in December, 1821. After she struck, she swung off, and then immediately tried for soundings, but got none. On finding the vessel sinking, the people took to the boat, and were picked up by another vessel. Captain Stokes had not seen Cape St. Vincent, but supposed it, at the time, to bear N.N.E. $\frac{1}{2}$ E. 28 or 30 miles. This information has been communicated by Captain Livingston, who says, "This information was given to me in Malaga, in September, 1822, by Captain T. Tankersly, of the schooner *Lord Mulgrave*, of London. Captain T. added, that he had met with another master (name forgotten), who said, he had observed the sea-weed on this rock; got out of his boat, and held on by some of the weed. He supposed the rock to be about 50 yards in circumference.

The preceding information is from Captain Livingston, who also says, "I was some years since informed by an old man of colour, a native of Goa, who was steward in a vessel I then commanded, that, while he was cabin-steward to Sir Edward Pellew, while captain of H. M. ship *Indefatigable*, that she struck on a rock off *Cape Finisterre*. This, I understand, has been denied, and it appears truly: for I have now information on which I can rely, from a very respectable naval officer, whose name I do not consider myself at liberty to mention, that the *Indefatigable*, when commanded by Sir Edward Pellew, actually struck on the rock, or a rock, off *Cape St. Vincent*, and received some damage.

I had no doubt, before, that she had struck somewhere, as I had a perfect confidence in my old steward's veracity: the error was in memory only."

It is much to be regretted that the true position of so dangerous a rock is not yet ascertained. (*Letter, 28th Oct. 1822.*)

CLEVELAND REEF, off Cape Geer. This reef, or bank, was discovered by Captain Cleveland of the royal navy, in 1765, who has described it as one mile in length, from north to south, and about 50 feet broad; and having on its shoalest part only three feet of water. This dangerous shoal is about nine leagues distant from the coast, in lat. $35^{\circ} 45'$.

FALCON ROCKS, to the northward of Porto Santo. The situation of these rocks has been already given in the description of the Madeiras, page 205. They had previously been vaguely and erroneously described as a bank, on which Francis Doublet, of Honfleur, grounded, to the N.E. of Porto Santo; and as a ledge, on which a Dutch ship was lost.

THE EIGHT STONES, to the northward of Madeira. According to M. D'Après, these rocks were discovered by Captain Vobonne, of London, in 1732, and by a vessel of Bordeaux, going to the West-Indies. Captain Vobonne counted eight rocks even with the surface of the water. He placed the southernmost of them in $34^{\circ} 30'$, and the northernmost in $34^{\circ} 45'$ N. lat.; he gives them 3 leagues of extent from east to west; and adds, that the southernmost rock is 40 leagues N. 5° E. true from the east end of Madeira. M. Fleurieu, having considered that Capt. Vobonne must have ascertained the latitude of this danger, either by an actual observation made when in sight of it, or else by dead reckoning, calculating his distance run from it to the east point of Madeira, concludes that, in the latter case, if the east point of Madeira were not laid down upon the charts then existing as it is now, the position ascribed to this danger by Capt. Vobonne must partake of the error. Now the English and Dutch charts of that time lay down the east end of Madeira in $32^{\circ} 30'$ N. lat. only; and, in an old English chart, this danger is laid down agreeably to Capt. Vobonne's description, and on that chart the east end of Madeira is placed in $32^{\circ} 30'$ N. In our chart the reef appears extending from $34^{\circ} 40'$ N. to $34^{\circ} 50'$ N., in longitude $16^{\circ} 35'$ W. If, however, Capt. Vobonne determined its latitude by observation, then its position, as given by him, will be correct. We have adopted the idea, that Capt. Vobonne ascertained its position by *dead reckoning*, and have therefore placed it on the chart according to the *corrected* latitude and longitude; and, of course, rather more to the northward than Capt. Vobonne, although nearer to Madeira than he stated it to be.

Messrs. Verdun, Borda, and Pingré, observe how surprising it is that a danger of such large extent should not have been discovered before the year 1732, and that it should not have been often seen since, so much frequented as these latitudes are. It is, however, inserted on the chart, without pretending to vouch for its existence.

JEAN HAMON'S ROCK, in lat. $36^{\circ} 54'$ and long. $19^{\circ} 49'$. The existence of this danger rests solely on the authority of Jean Hamon, commander of the *Trois Amis*, of Bordeaux. On the 8th of January, 1733, according to M. Bellin. he approached it within three-quarters of a league, and carefully observed it. He calculated its position by the course and distance run from the discovery of it until his arrival at the rock of Lisbon, which he made to have been E. by N. true, about 165 leagues. The late Captain Goodall, a gentleman long and well acquainted with the navigation of this part of the ocean, informed us, that he did not believe the danger to exist.

WHALE ROCK, in about lat. $38^{\circ} 46'$, long. 25° . M. Fleurieu exhibited this rock on his chart of the Azores, at about 29 leagues from St. Michael's, upon the report of a pilot, whom he knew at Angra, in Terceira. Its existence has, however, been disputed. The breakers shown on the chart, which were very high, were seen by Mr. R. Gradun, commander of the ship *Harmony*, of London, on the 8th of January, 1809: their latitude, by observation, being $38^{\circ} 46'$: and longitude, by account, $24^{\circ} 47'$. This affords reason for believing that the rock exists; the situation assigned by Mr. Gradun being very near that stated by M. Fleurieu.

Mr. Reid the British consul-general at the Azores, says, that he believes it really to exist; several masters of vessels, who have been blown to sea from St. Michael's, having told

told him that they have actually seen it, and that in form it much *resembles a whale*. The Rock has lately been diligently sought for, under an order of the British Admiralty, but without success; and it now seems clear that it cannot lie in the situation assigned by Mr. Gradun; yet it is still believed to exist not far off.

Captain Livingston says that, "While at Malaga, in September, 1821, Captain Finlayson, of the Duke of York schooner, of Portsmouth, informed me that some years since, when Captain Bartholomew, R. N. was at St. Michael's, about the time he was sent by the Admiralty in search of the Whale Rock; the Nautilus schooner, of Plymouth, arrived at St. Michael's. After Captain Bartholomew's departure, the commander of that vessel told Capt. F. that, on his passage out, having a chronometer, he remarked to his mate that, if the Whale Rock existed in the situation assigned to it, they must pass near it. Accordingly, in the mate's watch that night, the vessel ran through a very heavy break, which alarmed them much; but, before they had time to take any precautionary measures, the vessel was again out of the broken water, and the captain believed they had passed close to the Whale Rock. No person about Angra seems to doubt its actual existence; and one man, I understand, gives a very distinct account of its appearance and situation; having, when he saw it, carefully noted particulars in his journal; he is an Irishman, mate of a trading vessel between Angra and Lisbon, but unfortunately was not at Angra, when I was there. The last time Capt. Bartholomew was at Angra, this man was introduced to him, and stated, on being shewn Captain B.'s former tracks in search of it, on the Admiralty Chart, that he never had been near its actual position.

It seems generally believed at Angra, that actually two heads of rock are occasionally seen above water, and it is even reported, that a vessel once passed betwixt them.

TULLOCH'S ROCKS, in about $37^{\circ} 27' N.$ and $24^{\circ} 45' W.$ These were discovered, in 1808, by Captain Wm. Tulloch, of the brig *Equator*, of Portsmouth, New Hampshire, on a voyage from Madeira to St. Michael's, as already shown and described in page 191.

ST. MARY'S BANK, to the S.W. of $35^{\circ} 53' N.$ and $27^{\circ} 19' W.$ "On our passage, in 1819, from Havanna to the Island of St. Mary, in about Barcelona, we passed over white water, apparently a shoal, to the southward and westward of St. Mary's: the captain would not allow the vessel to heave to, in order to sound; but I have no doubt in my mind of its being a very extensive bank of soundings; and I have little doubt that I have ascertained its position tolerably accurate from lunars, antecedent and consequent. I should not be surprised if it turned out that the bank we passed over was connected with the *Kutusoff Bank*, marked in a late edition of Admiral Espinosa's chart, as having been seen in 1816, and which lies to the S.W. of the one we passed over, at the distance of about a degree. We were some hours crossing the bank.

"The Bank lies in latitude $35^{\circ} 53' N.$, as calculated, by account, between the observations of the noon before and noon following; longitude, $27^{\circ} 19'$ West of Greenwich, calculated by account of angular distance of sun and moon, two days prior, and star *Pollux* and moon three days subsequent; and which, calculated both backward and forward, agreed very nearly. I have heard a French gentleman, a Lieut. de Vaisseau, mention what I suppose to be the same, at the Table d'Hôte, at St. Michael's, in October, 1818.

"I am of opinion that this bank, when better known, will be of much use to vessels coming across, for determining their position by; and it is to be hoped that some of his Majesty's ships will examine it; for, however much the master of a merchantman may be inclined to examine, he may not delay his vessel. *Andr. Livingston.*"

THE STEEN GROUND, to the westward of Madeira. M. Bellin, in his Memoir of 1742, observes, that he places this danger 60 leagues to the westward of Madeira, as according with the most general opinion; but a manuscript chart of M. Radouay has a danger 35 leagues westward of that island, which is most probably intended for the same. Vankeulen's charts have in it 32° lat., on a parallel with the south-west point of Madeira. On the charts of the Coast of Africa, published at the Dépôt in 1753, it is in $32^{\circ} 2' N.$ lat., but only 45 leagues from Madeira. On the Atlantic chart of 1757, it is in the latitude of the west point of Madeira, but it is 60 leagues distant. Upon the chart of 1766, the name only, *Steenground*, is inserted. On the chart of Mr. Jeffreys, it does not appear at all. Neither are any account or particulars of this danger to be found. There is a very good reason to doubt

its existence; at least, it is certainly not as Vankulen represents it; he makes an island of it, with a sand-bank on the western side.

JOSYNA ROCK, in lat. $31^{\circ} 40'$, and long. $23^{\circ} 45'$. On this danger it has been stated that the Josyna, of Flushing, was lost in August, 1697.

The latitude observed, and the distance 110 leagues from Madeira. In the late Spanish chart, it is said to have been seen in the year 1805. This chart places it in latitude $31^{\circ} 40'$, longitude $23^{\circ} 45'$, as above, and the position which we have adopted.

VIGIA to the S.W. This Vigia was exhibited on Bellin's chart of 1742, in $37^{\circ} 50'$ of Flores. N., and longitude $34^{\circ} 18'$. It was repeated on the charts of 1757 and 1766, but nearer to Flores; and is supposed to have been originally copied from the Dutch charts: therefore is its position, and even existence, very doubtful. Upon some charts, it is called Martyr's Shoal; and upon others, described as a rock, called, by the Portuguese, *Vigia dos Açores*.

CANDLER'S ROCK, in about $39^{\circ} 45'$ N. and $35^{\circ} 10'$ W. This rock, which lies to the westward of Flores, was seen, a few years ago, by Captain Candler, of the Betsey, of Boston, who thought it to be 100 feet in height. A statement of its position, as calculated by the discoverer, was communicated to our friend, the late Mr. F. Owen, master-attendant at Jamaica; but, acceptable as it would have been, we have not yet had the pleasure of receiving it.

CHANTEREAU'S VIGIA, in lat. $38^{\circ} 24'$, and long. $39^{\circ} 25'$. This vigia which has been described as a white rock, was seen by Captain Chantereau, of the ship L'Auguste, in coming from Martinique, 6th September, 1721, when the sea broke on it very much. Its situation is extremely uncertain.

BRETON'S ROCK, about lat. $39^{\circ} 40'$, and long. $41^{\circ} 35'$. This shoal, according to M. Bellin, was seen by Breton, a pilot of Rochelle, who marked it merely as a rock. Laisné, another pilot, has also placed it in nearly the same latitude and longitude. It may be the same as that which Roland, a pilot of Tremblade, sounded; and also seen by Jean Desmaries; there being scarcely 10 minutes difference in latitude, and, in longitude, not more than a degree. The situation originally assigned was $39^{\circ} 45'$ N. and $41^{\circ} 25'$ W.

This danger was again seen, in 1816, by the ship Tiger, on her passage from Barbadoes to Liverpool. The letter of a passenger states that, "On the 14th of March, at 10 a.m. a smart breeze from the S.W., with studding-sails set, going seven knots and a half an hour, steering E. by N., true, in lat. $39^{\circ} 40'$, long. $41^{\circ} 40'$, we passed over a very agitated rumbling sea. Under our starboard bow, in appearance about a circle of a mile, was a small field of dark brown rock-weed, apparently a confirmed fixture: entangled with the weed were two pieces of spar, seemingly very much decayed. I am positive that this is a danger which ought to be carefully avoided by all ships coming to Europe from the West-Indies and America, as it lies directly in the track." (*Newspaper*, April 15, 1816.)

We are still at a loss for the position of the shoal; as it does not appear to have yet been correctly ascertained.

Rocks to the Eastward of the Bermudas. The different charts of the Atlantic exhibit rocks at about a hundred leagues to the east of the Bermudas, upon the authority, it is probable, of Bellin, who has stated that, "About 100 leagues to the east of Bermudas, there is a little shelf of brittle rocks, which has been seen by one Louis Duhal, in a corsair, or privateer, that sailed around them; and as this shelf is nearly on the parallel of the Bermudas, many have mistaken it for the rocks about those islands. M. Bellin has observed that, there are some rocks on this shelf whose tops are above the water; but that many doubt its existence.

Captain Livingston has informed us that he has met several persons who say they have actually seen those rocks, at about 100 leagues to the eastward of the Bermudas; and, he adds, that the Francis Freeling, Post-Office Packet, Captain Bell, fell in with others, in or about the year 1810, of which a public notification was given on the return of that vessel.

Captain Livingston subjoins the following remark: "A rock, or rocks to the eastward of Bermuda, I really believe to exist somewhere, as I have seen more than one individual who alleged having seen such: one, in particular, a Baltimore skipper, assured me that

that he passed near one, and that it was a black cindery-looking rock, spotted with the dung of sea-fowl, and about six feet above water. There are too many assertions of something having been seen to the eastward of Bermuda to permit us to suppose that such notices can have originated in mere imagination; besides, seamen are apt enough to be careless in keeping a good look-out; and it is better they should fear that which does not exist, than fall victims to a belief of the non-existence of a real danger."

We have subsequently made enquiry as to these vigias, and have been consequently informed that the rocks, supposed to have been seen by the late Captain Bell, were placed in about $33^{\circ} 45' N.$, and $55^{\circ} 25' W.$ The late Captain Hurd, who surveyed the Bermudas, assured us, that he did not believe rocks to exist in the position assigned: and he supposed that some who had advanced by error, too near the reefs to the eastward, or north-eastward, of the Bermudas, mistook them for rocks at a much greater distance from land.

Another gentleman says, "I have enquired of Captain Bell's executors, who inform me that they have no journals or rough log-books, of their late friend: but I believe that I can tell you how the supposed reef of rocks arose. The Freeling packet, returning from Jamaica, under the command of the master, Mr. Nankivell, on the 13th June, 1811, fell in with a rock, in lat. $35^{\circ} 50'$, long. 56° ; which, not believing to exist, I examined him pretty strictly about. He said he passed very closely to it; that the base was of a yellowish white colour, and the top black; that he never fired at it, sounded, or hoisted his boat out, to examine it, which he might have done, as the weather was very fine and moderate. Nankivell, who was afterwards killed in action, was sadly hoaxed about it, and I marked the situation, in a chart of the Atlantic, in his presence, giving it his name. He was always positive about it, and I have no doubt, he saw something like what he described, and it may be some volcanic matter thrown up and sunk again: but, my opinion is, that it was a dead or sleeping whale; for Captain Kirkness, of the Dispatch packet, passed, a short time afterwards, in nearly the same direction, several whales sleeping or basking in the sun."

See, farther, the GENERAL NOTE, at the conclusion of this section.

A rocky bank, lying to the S.W. of the Bermudas, has been already noticed on page 237.

ASHTON ROCK, between Ber- Ship Wm. Ashton, Captain H. B. Guy, 22d May, 1824. "At $11\frac{1}{2}$ 50m. the man at the wheel mudas and Cape Hatteras. saw something on the starboard bow, distant about one mile. Hauled the ship towards it, when we discovered it to be a rock: passed to the westward of it at the distance of about two cable's length. The base of the rock appeared to be about 100 yards in circumference, on which the sea broke. In the centre was a point of rock in a form of a sugar-loaf, about 8 feet above the water, with a quantity of weed about it. Passed the lead forward; no ground at 80 fathoms. Blowing fresh, too much sea to lower the boat down.

Latitude of the rock, by a good observation, $33^{\circ} 48' 50''$; long. inferred from lunar 21st May, at 19h. 31m. $71^{\circ} 41' 20''$. The rock bore from us at noon S. 41° W. seven-tenths of a mile.

BANK between the Bermudas "Mr. Owen, late master-attendant at Port-Royal, mentioned to me among the last times I and Bahamas. had the pleasure of seeing him, that a bank, of

18 or 20 fathoms water, had been discovered by some of H. M. ships, between the Bermudas and Bahamas; but Mr. O. had not obtained any particulars of its position."—A. L.

This is inserted only as an object of future investigation.—Ed.

BETWEEN THE LATITUDES OF 20 AND 30 DEGREES.

Rock between Canary and Tenerife. This rock, of doubtful existence, is exhibited on the chart of M. Borda, as already shown, in the Description of the Canary Islands, page 210.

GOMBAUD'S ROCK, in lat. According to M. Fleurieu, this danger was first seen $23^{\circ} 15'$, and long. $32^{\circ} 25'$. in 1764, having been discovered by Gombaud, the commander of a merchant-vessel of Rochelle. Upon this authority, and this alone, it has been continued. Google
Overfalls

Overfalls, or Heavy Ripples, in "On Sunday, the 7th Feb. 1819, at 10 a.m., lat. $24^{\circ} 11'$, and long. $61^{\circ} 44'$. the schooner Brilliant, Capt. Tulloch, on her passage from Gibraltar to Havanna, passed through very heavy overfalls, extending N.N.E. $\frac{1}{2}$ E. and S.S.W. $\frac{1}{2}$ W., true, as far as the eye could reach, with much sea-weed (*fucus natans*) in it. The breadth of the overfalls did not exceed half a mile. Course run from 10 a.m., W. by N., 6 miles an hour, equal to 12 miles. Latitude, observed at noon, $24^{\circ} 10' 38''$. Hence the latitude, in which we crossed the overfalls, was about $24^{\circ} 11' 11''$, after allowing $1' 45''$ S. for heave of the sea. The longitude of the overfalls, I found, by mean of three sets of lunars, stars Regulus and Aldebaran, east and west of the moon, continued to noon, by account, was $61^{\circ} 43' 57''$ W. The preceding information was communicated by our friend Captain Livingston, by whom the lunar distances were taken. He adds, "None of us saw such a heavy ripple, except near land, before; and both Captain Tulloch and I felt confident that, if there had been a fresh breeze, the overfalls would have broke very heavily. We saw no danger, but both suspect some one exists hereabout."

Mr. Cooper, late teacher of mathematics at Greenock, was, some years since, on a voyage from Martinique towards the United States; and, in nearly the latitude and longitude of the Overfalls, above described, the ship ran through a ripple, wherein the water appeared almost as red as blood; and, he thinks that, if the current had run over a red sand-bank, of not more than 20 fathoms, the water could not have been redder. The captain declined sounding, and farther particulars are unknown." A. L.

We have distinguished the Overfalls, on the Chart, by the name of the gentleman to whom we owe this information.

MOURAND'S BANK, in lat. This danger was discovered by Mourand, commander of the Prince de Nizarré, of Nantes, on the 6th of April, 1773. This person has the character of having been an intelligent navigator and accurate observer. He describes it to be a "bank of red sand, many parts of which are out of water, like detached islands, over which the sea breaks: it appeared to extend about a quarter of a league from North to South." The journal of Captain Mourand's voyage having been submitted to the consideration of Messrs. Verdun, Borda, and Pingré, they have been enabled to calculate, with every probability of correctness, its true position.

GUIGOU'S BANK, in lat. M. Bellin, in the Memoir of his Chart, of 1742, describes this to be a "rocky bank, about 45 leagues to the northward of Porto Rico, upon which a Dutch vessel was lost in 1701, and that it had also been seen by a French vessel." Another manuscript, in the Dépôt de la Marine, confirms this account, and adds, "The commanders of both vessels declare, that a little island of sand appears on the middle of the bank, in latitude $21^{\circ} 24'$, and that the bank is 3 leagues in length. It also appears, from the deposition of Christopher Whipple, commander of the Anna, of Rhode Island, that he was wrecked on the 27th of November, 1733, upon a shelf, from 30 to 40 leagues to the northward of Porto Rico; which, there is little doubt, must be the same. In the Marine Dépôt of Paris there is a manuscript, entitled, "Plan of the Shelf which was discovered by Capt. Michael Guigou, of Seine, in Province, on a voyage from Cape François, in the ship La Concorde, February, 1688." On that plan it is placed at 45 leagues to the northward of Porto-Rico, somewhat nearer to the western than to the eastern end. It has been subsequently represented in different situations. That, given above, is the probable mean. This bank has been called the *Porto-Rico Shoal* and *Bajo del Flamengo*.

VIGIAS BETWEEN THE EQUATOR AND THE PARALLEL OF 20° .

MARIA'S ROCK, in lat. On this shoal, in lat. $19^{\circ} 45'$, longitude computed, about $19^{\circ} 45'$, long. $20^{\circ} 50'$. $20^{\circ} 50'$, the Portuguese schooner Maria struck, and lost her rudder, on the 31st of January, 1813.

This shoal, with others supposed to exist in its vicinity, was sought for, but not found, by Captain Bartholomew, in H.M. ship Leven, in 1819. At about 10 leagues more to the southward, in lat. $19^{\circ} 20'$, and long. $20^{\circ} 37'$, the Admiralty chart represents a shoal seen in the Portuguese schooner, *Bom Félix*, J. Dultra, master, who sounded in 4 and

5 fathoms, and who has stated that the two extremes appeared to have only 4 or 5 feet of water. The date is not given.

BONETTA ROCKS. That the rocks bearing this name, eastward of Bonavista, exist somewhere to the eastward or E.N.E. of Bonavista, there can be little doubt, although they have been unsuccessfully sought for, as above. They were described by the late Mr. Norris, who stated that their extent was about $3\frac{1}{2}$ miles in extent from S.W. by S. to N.E. by N. and the greatest breadth about a mile and a half. At $2\frac{1}{2}$ miles to the southward of them, 35 fathoms of water, small white gravel stones, were found; then 30, same ground; and then, at $1\frac{1}{2}$ mile, 20 fathoms, red coral rocks. They were stated to lie at 42 leagues E. by N., true, from Bonavista, and therefore in about $16^{\circ} 32' N.$ and $20^{\circ} 37' W.$ a position not crossed by Capt. Bartholomew, who has omitted them in his chart.

Warley's Shoal, in Of this shoal the following is the only description:—
lat. $5^{\circ} 4'$, long. $21^{\circ} 25'$. "In latitude $5^{\circ} 4' 23'' N.$, and longitude $21^{\circ} 25' 40'' W.$, is a shoal, over which the Warley, E.I.S., passed on May 7, 1813. They had no time to sound, but supposed that there were about seven fathoms on it: the bottom was distinctly seen, and consisted of ridges of rocks, with sand between them. It is of small extent, not exceeding a quarter of a cable in length."

FRENCH SHOAL, in lat. This shoal has been described as three leagues in circumference, and even with the water's edge. It is stated to have been seen by several French East-India ships, and placed, by the French hydrographers, in latitude $4^{\circ} 15' N.$, long. $19^{\circ} 20'$. The late Spanish chart states it to have been seen in 1796, and a modern English chart exhibits it in latitude $4^{\circ} 5' N.$, and long. $20^{\circ} 33'$, the position which we have adopted.

CÆSAR BREAKERS, in lat. Of these we know no more than that they are stated
 $2^{\circ} N.$, and long. $22^{\circ} 18'$. in the chart of M. Rochette to have been seen in 1730. The existence of them may, therefore, be considered as very doubtful.

PENEDO DE ST. PEDRO, This isle is composed of an assemblage of steep rocks, otherwise called St. Paul's. without verdure, covered with bird's dung, and having no place fit for anchoring or convenient for landing. It appears, at the distance of 5 or 6 leagues, like several distinct rocks. The appearance annexed was lately communicated by the intelligent master of a merchant-ship.



The rocks change materially in their appearance according to their bearing. Mr. Alex. Coffin, of the American ship *Diana*, took two appearances of them in 1795, and mistakenly presumed, from their appearance, that they formed separate islands. The *Tellicherry*, East-Indiaman, passed in sight, in 1802, and found that the appearance, between $N. 30^{\circ} W.$ and $N. 37^{\circ} W.$, 6 or 7 miles distant, was that of a heap of rugged rocks, with low gaps between some of them. The northernmost, a small pyramidal rock, rather lower than the rest. The whole appeared to be rocks, about the height of a ship's mast from the sea. They afford no water.

From observations made in the *Thames*, in 1798, compared with those made in five other ships, it is inferred, that the isle is situated in latitude $0^{\circ} 55' N.$, and longitude $29^{\circ} 15'$. This longitude agrees with the lunar observations of the *Thames*, which varied only one minute from the result of those made in the *Union*, 1800, and five minutes from that of the *Tellicherry*, in 1802, the latter being to the West.

Captain Williams has said, "I should suppose a ship might be on shore in the night, before she would be able to see the island, unless the noise of the surf were loud enough to warn the navigator of the danger."

The variation here, in 1802, was 6° West. We have reason to suspect that the true longitude is rather to the eastward than to the westward of the situation above assigned; as one of the time-keepers in the *Thames*, 1st December, 1798, gave only $28^{\circ} 55'$ West.

SHOAL, in about lat. $0^{\circ} 25'$ N. long. some time since struck on a coral reef, in about $0^{\circ} 25'$ or $0^{\circ} 26'$ N., when the master reckoned himself about 500 miles from the Brazilian coast. The evening was fine; she did not hang long, having first grated, and afterwards struck twice or thrice. My informant (Captain Lyall, of the *Anne* of Liverpool), was on her survey at Para, and says, that pieces of coral, nearly as large as a man's hand, were then sticking in her bottom." *And. Livingston.*

The INDIA SHOAL, West This shoal is laid down from the chart of M. Rochette, of Cape Verde Islands. 1777, on which it is stated to be mentioned in several journals of East-India ships, and to lie 70 leagues W. by N., (*true*) from St. Iago. We are unacquainted with the nature of the danger; but have placed it as it before appeared. Its position may be considered as very uncertain.

DUBREUIL'S VIGIA, in lat. This danger (adopted by M. D'Après) rests upon the authority of M. Dubreuil, commander of the French frigate *La Serieuse*, who stated that, in his passage from Senegal to the West-Indies, in 1753, about 95 leagues West of the Island Brava, he thought he saw a danger. M. Bellin, in his chart of the Atlantic Ocean, published in 1766, places two dangers, W. some degrees S. of the Island Brava, from 106 to 112 leagues distant. These two dangers are undoubtedly no other than that mentioned by M. Dubreuil; which is probably the same with the *Abrothos* of the old charts, and placed at 85 leagues W. by S. from Brava.

BAXO das GARCAS, lat. This can be considered as nothing more than a very uncertain *vigia*. The only notice that we have of it states that it lies, according to the Dutch chart, 107 leagues true W.S.W. from Brava.

VIGIA de 5 PALMAS, lat. 12° , long. $27^{\circ} 20'$. This *vigia* has been also called *Hinman's Shoal*: we therefore presume that it may exist; but its situation is uncertain. Hinman's Shoal has heretofore been laid down very nearly in the same latitude, but a degree more to the eastward.

TEXEIRO'S SHOAL, in lat. $12^{\circ} 0'$, and long. $33^{\circ} 32'$. The only notice we have of this is on the Spanish chart of Admiral Espinosa, which states it to have been seen on the 16th of April, 1810. Latitude and longitude observed. The nature of the danger is not, however, explained.

LONGCHAMP'S ROCK, lat. $9^{\circ} 47'$, and long. $30^{\circ} 0'$. The only authority that we have for this is the old Dutch chart, which is but one shade better than no authority at all. Former charts state it as probably the *Solis Isle* of the antient navigators.

MAALSTROOM, in about lat. $16^{\circ} 0'$, long. 37° . This bank, or whirlpool, first appeared on the chart of M. Vankeulen; upon which authority alone it rests; as we do not know that it has been seen since, nor have any particulars been given as to its depth of water, &c. We must, therefore, consider it as very doubtful.

M. de Humboldt, on his passage to the West-Indies, 3d and 4th July, 1799, says, "We crossed that part of the ocean where the charts indicate the bank of the Maalstroom; toward night we altered our course, to avoid this danger, the existence of which is as doubtful as that of the isles Fonseca and St. Anne. As we approached this pretended Maalstroom, we observed no other motion in the waters than the effect of a current setting to the N. W." (*See Galissioniere's Rock, on the next page.*)

GALLEON'S BANK, in lat. $15^{\circ} 56'$, and long. $49^{\circ} 40'$. This bank, or reef of rocks, was discovered on the 23d of July, 1730, by Longueville, the pilot of the *San Fernando*, commanded by M. de Navarro, Admiral of the Spanish Galleons. By the detail into which Longueville enters, concerning this danger, (his journal being in the *Depot de la Marine* at Paris,) there can be no doubt of its existence. It appears that the *San Fernando* struck on and passed over it, without receiving any damage. Other ships in the same fleet also struck, with more or less violence, but without actual injury. In the *Depôt de la Marine* there is also a memorandum of the existence of a bank, in 15° N. lat. and 228 leagues East of Martinique upon which there

there is said to be 40 fathoms of water, bottom of fine sand; and over which Joachim Voëtte is said to have passed and sounded. Who this Joachim Voëtte was, is not mentioned, nor when he ascertained its position. If, however, this last-mentioned bank really exists, it may be the same as that over which the Spanish galleons passed.

M. de Humboldt has noticed that there exists in the parallel of the Island Dominica, and very near the 55th degree of longitude, a space wherein the water seems *constantly milky*, although the sea is very deep: and he asks, May there not be, in this place, some sunken volcanic islet?

We have already had occasion to notice the luminosity of the sea, as occasioned by mollusca, &c. (see page 211,) and shall here add a note from the narrative of the late Captain Tuckey, in order to shew that the sea may be white without the agency of a volcanic islet. After passing Cape Palmas, and entering the Gulf of Guinea, Captain Tuckey observed that the sea had a whitish colour, which gradually increased till they made Prince's Island. The luminosity of the sea also increased, so that, at night, the ship seemed to be sailing on a sea of milk. In order to discover the cause of these appearances, a bag of bunting, having its mouth extended by a hoop, was kept overboard, and by means of it they collected vast numbers of animals of various kind, particularly pellucid *scalpæ*, with innumerable little crustaceous animals of the *scyllarus* genus attached to them, to which Captain Tuckey attributed principally the whitish colour of the water. Thirteen species of *cancer* were caught, not above one-fourth of an inch long, eight having the shape of crabs, and five that of shrimps. Among these, the *cancer fulgens*, (a kind of little shrimp, emitting light,) was conspicuous. When another species was examined by the microscope, in candle-light, the luminous property was observed to reside in the brain, which, when the animal was at rest, resembled a most brilliant amethyst, about the size of a large pin's head; and from this there darted, when the animal moved, flashes of a *brilliant silvery light*."—*Tuckey's Voy.* page 49.

DISCOLOURED WATER, 100 At 3, p. m. on the 15th July, 1792, Don Cosmé leagues Eastward of Barbadoes. de Churruca, then on his passage to the West-Indies, discovered a boiling and breaking of the sea, so very extraordinary, that it appeared to be breakers; but they found no bottom at 150 fathoms. This phenomenon, which appeared to be in consequence of a current setting against the wind, accounts for the differences between the Observations and Dead Reckoning. Such circumstances as these have doubtless often given rise to a belief in the existence of Banks and Vigias which had no being.

On the 16th, at 10 a. m., they were in latitude $13^{\circ} 56'$, and longitude $54^{\circ} 7'$ West of Greenwich: and observed that the colour of the water changed, looking like muddy river water, or as if they were on a bank. They were 128 leagues to the Eastward of the middle of St. Lucia, and 150 to the N.E. of the mouth of the Orinoco. They continued their course without alteration; sounded at night, and found no bottom at 120 fathoms. The Captain, Churruca, says, that the colour is always the same in that part of the ocean, always appearing as if on soundings, in that latitude and longitude, and that it never varies the position of its limits: and, in addition to his own remarks, he had assured himself of the fact by information collected from various sources, and that also the English sailing directions for the year 1782, entitled the *Complete Pilot for the Leeward Islands*, in the account of Barbadoes, mentions that this phenomenon is found at the distance of 70 or 80 leagues to the Eastward of that Island, and that there are no soundings, though the water seems as if there were.*

The passage above quoted, from the old Book of Directions, is as follows:

"In the latitude of Barbadoes, about 70 or 80 leagues to the eastward, you will find the water discoloured, and prodigiously thick, as if there were soundings; but there are none, and you may depend on being at the distance aforesaid from the Island." See further, *Colombian Navigator*, Vol. II, p. 47.

* It seems that the appearance of Soundings described above, occurs in the same place where Capt. Tulloch told me a bank existed, which some Americans were in the habit of making, as a fresh point of departure, when bound to Surinam, &c.—A. L.

GALISSONIERE'S ROCK, This vigia was exhibited on the chart of M. Rochette as or Isle of Fonseca. a rock mentioned by M. Galissoniere and some other navigators. A spot, nearly in the same situation, had previously been called the *Isle of Fonseca*. It is said to have been seen by the Rainbow, a man-of-war. We have been lately informed, though vaguely, that the rock has again been seen.

MARTIN'S REEF, Eastward A shoal was inserted hereabout on the chart of of Guadaloupe, in about $16^{\circ} 40'$ Bellin, 1742, who says that it is mentioned by many N. and $58^{\circ} 40' W.$ navigators. "It was again seen in July, 1816, by Captain Martin, of the ship John Manning. The shoal seemed to consist of yellow sand, with sea-weed upon it: to be about half a mile in length from East to West, and a quarter of a mile in breadth, from North to South."

We have been informed, on respectable authority, that this reef was again seen in 1823; "it appeared extensive, and a little under the water.

Rock to the Northward An American schooner, in 1817, struck on a rock to the northward of Porto-Rico, in latitude about $20^{\circ} N.$; of Porto Rico. therefore it could not be on either Mourand or Guigou's shoals, nor yet on Hannas breakers. We have to regret that, in this, and several other instances, we have not farther and more accurate information.

The *American Coast Pilot*, vaguely says, that, at 50 miles North from Porto-Rico, the brig Robert, Captain Baxter, struck on a rock and remained several hours. Can this be the same?

ST. ESPRIT REEF, in lat. The following is a copy of a notice published in the $14^{\circ} 37'$, long. $58^{\circ} 59'$. London Daily Papers of October, 1817: "On the 4th of July, 1817, the French ship St. Esprit, bound from Marseille to Martinique, in latitude $14^{\circ} 37'$, longitude $64^{\circ} 18'$, 35 leagues distant from the island, fell in with a chain of rocks, about 8 feet under water, extending about 500 fathoms from North to South, and being about 100 fathoms broad, and were plainly seen on the bottom from the vessel. According to a sketch given of them by the Captain, they lie somewhat in the form of a half-moon; and the ship running westwardly with a strong wind, got within its horns, and narrowly escaped being wrecked, but made her way out by the south point. The reef, it seems, from its situation, must have been of recent formation, as it is in the track of vessels bound to Martinique, and is not known to have been before observed."

REMARKS ON THE PRECEDING NOTICE.—There is reason to believe that this is not a new discovery, although the situation of the danger has not been heretofore ascertained. In the *Dépôt de la Marine*, at Paris, there is a memorial, which states that Captain Pierre Renault, commanding *L'Automne*, of Bourdeaux, believed that he saw a danger in latitude $14^{\circ} 55'$, sixty leagues to the eastward of Martinique, on the 17th of May, 1723. He said he was within musket-shot of it; but, although he places it in latitude $14^{\circ} 55'$, he could not observe the latitude, the sun being too near the zenith.

Another indication of a shoal, generally considered as merely imaginary, has appeared in the parallel of Martinique, at the distance of 80 or 90 leagues from the island. This was introduced on the authority of a Captain Laborde, of Bordeaux, who stated that he saw a danger in the parallel of Martinique, at the distance above mentioned: "He was satisfied, by the change in the colour of the water, that it was a sand-bank, upon which there appeared to be water enough for a ship to pass over in safety."

All these notices seem to be imperfect. Renault believes that he saw a shoal, but he ascertains neither latitude nor longitude, and the distance from Martinique is given very vaguely. Laborde says, that a *Bank* exists in the parallel of Martinique, but his longitude is as vaguely given as the former: and this is not extraordinary: for an error of 40 or 50 leagues in longitude was very common half a century ago. The captain of the St. Esprit says, that the reef lies in latitude $14^{\circ} 37'$, and longitude $64^{\circ} 18'$. This longitude is from the meridian of Marseille, which is $5^{\circ} 22'$ East of Greenwich, and the corresponding longitude from the latter is $58^{\circ} 56'$; but the distance from Martinique he gives as only 35 leagues, and, if we assume the easternmost point of that island as given

in the new Chart, this would give longitude $59^{\circ} 2'$, being $6'$ more to the west. The mean of the two, or $58^{\circ} 59'$, may, therefore, be considered, for the present, as the longitude of the Reef, to which we have attached the name of the ship *St. Esprit*.

BANK to the S.E. "I have heard of a 30-fathom bank, of great extent, to the S.E. of Barbadoes, and that many of the Americans who used to trade to Demerary knew its position, and were in the habit of making it, and taking their departure from it for the main-land.—*It may be worth enquiring after.*—*Andrew Livingston.*"

GENERAL NOTE ON THE VIGIAS, &c.—This section may, with propriety, be concluded in the words of M. de la Rochette; who has said, "We neither take upon us to certify the existence or the position of all these vigias; as it is extremely possible to mistake one for another, or to repeat them, especially those of which the position depends on the estimate or guesses of mariners."

"It is, moreover, possible, that navigators, at a certain distance, may have mistaken whales for shoals. M. de Chabert, in his voyage to America, in 1741, for the purpose of making astronomical observations, being at the distance of 70 leagues from Corvo, one of the Azores, descried a dusky body, over which hovered a number of gulls, a bird seldom seen at such a distance from land: at first he imagined it to be a rock; but, on coming near, in order to observe it, he found it to be the carcase of a whale, of monstrous bulk. Besides, some of those vigias may have ceased to exist after having appeared for some time; as, for instance, the island, which rose out of the sea, in the year 1720, to the westward of St. Michael, of the Azores, and which disappeared again on the 17th of November, 1723."

As a monition against too hastily forming conclusions from mere appearances, we here add that an old friend of ours, in crossing the Atlantic, was once alarmed by the sight of breakers at no great distance. Instead of coming home with an imperfect report, he very properly sent out a boat to examine them, and found that they were caused by a floating body, thickly covered with barnacles, &c. to which a hatchet was applied, and soon disclosed a cask of wine, which proved to be excellent Burgundy. It had, no doubt, been floating many years, and during the time had probably been the prolific parent of a number of *vigias*, &c.

We have shown, in another work, how easily an animated as well as a lifeless being may be mistaken for a rock. In 1818, the *Northampton*, Captain Tebbut, on her passage to India, had passed the meridian of the Cape. On the 1st of August, at noon, the ship was in latitude $40^{\circ} 45'$ S. and long. $24^{\circ} 32'$ E. On the next day an object appeared right a-head, like a boat; on nearing, it looked like the wreck of a vessel, *two parts being above water*, at two ship's length from the lee-bow. The barnacles could be distinguished by the naked eye; but, when a-beam the creature *went down*. It proved to be a *thrasher*. Captain Tebbut says, being forward at the time we came up with the animal, the two parts above water seemed to me like a wreck, bottom upwards. When I first saw the barnacles, the part covered with them looked rugged, and I firmly was of opinion that it was a rock above water; so much so that I looked over the lee-bow to see that we were clear of it, ordering the man to starboard the helm."

In every event, however, it is always the safer course, in matters of this nature, to err rather by marking too many than too few, especially when we make known, as we have done, the authority that we rely on for the existence of each.

APPENDIX;

CONTAINING

HINTS AND REMARKS ON GENERAL NAUTICAL PRACTICE; WITH OTHER SUPPLEMENTARY PAPERS, TABLES, &c.

I.—MODE OF ASCERTAINING CURRENTS; LOG-LINE, LOG-GLASS, &c.; STEERAGE; SPANISH PILOTS; DEAD-RECKONING IN SHOAL WATER. *Communicated by Captain Livingston.*

IN allusion to some remarks, made by an able writer, in a critique on the Voyage of the Baron Alexander de Humboldt, Captain Livingston says, “the Reviewer censures M. de Humboldt for stating that, by comparing the place of the ship, as adduced from his chronometer, and comparing that with the pilot’s reckoning, he was able to discover the smallest variation in the direction and velocity of the currents. The reviewer also says, that the chronometer had not been rated: but on what authority he states this, I am at a loss to conjecture; as a man of Humboldt’s acquirements and abilities could not, for a moment, think of ascertaining the longitude by means of a time-keeper, of which he knew nothing of the rate: and, indeed, it appears, in the same paragraph, that Humboldt predicted the exact time at which the land would be seen, and which, we presume, must be from the use of this very chronometer; of which he, consequently, must have known the rate.

“There can be no doubt that the LOG-LINE, GLASS, &c., are liable to be erroneous; but if the master, or whoever acts as pilot, of a vessel, be attentive to his duty, any error in these will soon be discovered. For my own part, I can say that, rarely three days pass, when I am at sea, without examining the glass by the seconds’ hand of my watch, and causing the log-line to be measured by marks which I have always measured off on the deck; and the length I have found, by experience, to answer best is 45 feet to the knot for a 28-seconds glass, and $48\frac{1}{2}$ nearly for a 30”. In a vessel, however, the side of which was high out of the water, I have allowed something for the height of the side, which causes the line to make a different angle from what it does in a low one, and, of course, requires a little more length of line, proportioned to the vessel’s height out of the water: but, what has been so often stated by seamen, ‘that a fast-sailing vessel requires a shorter line than a dull one,’ I have found, from experience, to be inaccurate; as I have been in both remarkably fast and remarkably slow vessels; and a careful attention to the log has convinced me of the equality of the length of line necessary for both.

“What has been said relative to steerage is strictly true, that ‘a vessel’s head vibrates according to the skill or want of it in a helmsman;’ but it is really surprising how nearly, in general, the errors on the one side compensate those on the other; inasmuch, at least, as regards most vessels: a cutter, however, when running with the wind on the quarter, will always gripe to windward, in spite of the best helmsman.

“A sneer at the unskilfulness of SPANISH PILOTS is unwarranted.—Probably no country in the world produces better navigators than the Spaniards; as, in every maritime town, of note, they have a regular academy for Pilots, supported at the public expense, in which even the practical part of seamanship is taught on large models of full-rigged ships, which turn upon a pivot, so as to perform every manœuvre: and reefing or setting sails, with the other operations to be performed aloft, is done by means of such ladders as are used by painters. No person can take charge of even a *merchant-vessel*, as second pilot, until he has undergone a regular examination. If these regulations were adopted in Britain, it would be well for our underwriters, and save ‘many fine ships and valuable lives.’

"If CURRENTS are not to be ascertained by the difference between the ship's place by account and by observation, how are they to be ascertained? It may be answered, by the plan proposed in all school-books, which is, by sinking a pitch-kettle, or other heavy article, to a great depth, from a boat: this I have often tried, but the results never appeared to me satisfactory: besides, the log-line, vague as it may be, must, in this way, still be trusted to. Again, if a current can be ascertained in this way, it will be a surface-current only; and there may even be a counter-current beneath, which, from its action on the kettle, or heavy article, to which the boat rides, may make the surface-current appear to set more strongly than it really does.*

"I do not pretend to say that the mode of finding the set and velocity of currents, by comparing the ship's true place, as found by observations for latitude, or by lunar or chronometric observations for longitude, with that assigned to her by mere calculations of the courses and distances steered, is a certain one; on the contrary, I am conscious it is far from being so: but yet it seems to be the mode of practice by which the nearest approximation to the truth is obtained.

"If, on heaving the log, proper attention be paid to the mode of the person who heaves it, much inaccuracy will be obviated, and a person who has practice will come wonderfully near the truth. My own mode is, to take the average of the distance shown by the log at the beginning and end of the hour; as the distance run during it, except when any sudden increase or decrease of the ship's rate takes place, near the beginning or end of the hour, in which case I proportion it according to the best of my judgment; and often, under particular circumstances, I have caused the log to be hove more than once between the regular intervals of an hour, to satisfy myself. The error in turning the glass will seldom make one foot of difference.

"LEEWAY and HEAVE of the SEA must be taken into consideration. The former, in particular, is, at times, a puzzling subject, even to the most experienced, when a current prevails in any strong degree. Upon the whole, it must be allowed that, those only who are well acquainted with, and practise, lunar and chronometric observations, can be sure of their situation at sea. No dead-reckoning, however carefully kept, can guarantee this."

DEAD-RECKONING in SHOAL WATER, as on the COAST of GUYANA, &c.—"As the greatest uncertainty in the situation of a vessel arises from the errors in the dead-reckoning, caused by currents, to diminish such errors, and render the computation more correct, it is advisable to take off the log-chip from the log-line, and to substitute a leaden weight, weighing 4, 6, or 8, pounds, as may be judged necessary: this, taking the bottom, (when the log is hove with it, in place of a log-chip,) will not so easily follow the vessel, or be influenced by currents. By this mode, it is clear that the log will show the whole distance which the vessel runs, whether caused by winds or by currents. Then, having made fast the log-line, before you haul it in, mark the bearing of it, and

* "A surface-currents, it is to be observed, is the only one that affects a ship's way. I think that counter or under currents are seldom to be found in the open ocean."—*Abr. Bristow*.

On coasts, however, counter-currents may probably exist where they have been little suspected. Of this, a remarkable instance has been given by Captain BEAUFORT, R.N. in his classical and elegant description of the coast of KARAMANIA, or ASIA MINOR. "From Syria to the Archipelago there is a constant current to the westward, slightly felt at sea, but very perceptible along the shore, on this part of which it runs with considerable velocity; as, between Adratchan Cape and the opposite island, we found it one day almost three miles an hour. The configuration of the coast will, perhaps, account for this fact. The great body of water, as it moves to the westward, is intercepted by the western coast of the Gulf of Adalia; thus pent up and accumulated, it rushes with augmented violence towards Cape Khelidonia, where, diffusing itself in the open sea, it again becomes equalized.

"The cause, the progress, and the termination, of this current will form an interesting subject for future investigation. To trace its connection with the volume of water, which enters by the Strait of Gibraltar, the influx of currents from the Euxine (Black Sea), and the effect of the Nile, and of the lesser rivers of Asia Minor, will require a series of corresponding observations on both sides of the Mediterranean. The counter-currents, or those which return beneath the surface of the water, are also very remarkable: in some parts of the Archipelago they are sometimes so strong as to prevent the steering of the ship; and, in one instance, on sinking the lead, when the sea was calm and clear, with shreds of buntin, of various colours, attached at every yard to the line, they pointed in different directions, all round the compass."—p. 39.

the opposite point or direction will be the course which the vessel makes good. It is clear that, by this mode, the course and distance ought to be as exactly found as if no current existed. If you heave the log with a chip, in the usual manner, as well as a log with a lead attached to it, and compare the distance by it, and the course which the vessel appears to make by compass, with the distance and course found by the proposed method, you will be able to ascertain the direction and velocity of the current."*—*Derrotero de las Antillas*.

NOTE, BY THE TRANSLATOR.—In using the log-line with a leaden weight, as recommended above, I am of opinion that a few fathoms of extra stray-line should be used; and, if great accuracy be required, as in making the comparison between it and the common log, &c., to ascertain the strength of the current, an allowance should be made for the angle the line makes with the surface of the water, in order to equalize it with the log-line, as usually hove.—*Andr. Livingston*.

II.—ON THE COMPUTATION OF LATITUDE; WITH A TABLE FOR CORRECTING THE SUN'S OBSERVED ALTITUDE.

FOR the following Remarks on computing the LATITUDE, we are obliged to our friend Captain Abr. Bristow.†

"While so many able pens have been employed in improving the methods of finding the Longitude, the Latitude seems to have been neglected. Dr. Maskelyne, is, I believe, the only person who has given a clear and succinct rule for deducing it from a meridional altitude. It is much to be wished that this rule should be given in all our books of navigation, instead of the confused rules commonly found therein.

Dr. MASKELYNE'S RULE is given on page 14 of the Explanation of the *Requisite Tables*, and to the Example is annexed a brief scholium, stating that, 'It has been usual to divide the rule for this problem into different cases; but the necessity for such division arose from considering, improperly, the zenith of the place as a fixed point, instead of the sun.'—With deference, I should consider it of no consequence, whether either the zenith or sun be considered as a fixed point; and, in fact, neither of them are; but rather, a moveable *known* point is given, in order to find a moveable point *unknown*. On islands, or in ships at anchor, the zenith is stationary; yet, between the tropics, the denomination of the zenith distance is changed by the apparent alteration of the sun's place.

I would recommend to every person, when working his latitude, to attach the names to the zenith distance and declination, respectively, in order to prevent mistake; particularly when near the line, in the neighbourhood of the sun, or when the declination is only a few minutes from the equator.

I have been led to the consideration of this matter, as above expressed, by a circumstance or two which fell under my own observation. In the month of September, at the time the sun crossed the line, three or four ships, from the coast of Africa, were bound to the island of St. Helena, (in latitude $15^{\circ} 55' S.$) but, in consequence of their com-

* That is, the surface-current.—*A.B.*

† The scientific navigator may consider an injunction as to the necessity of adjusting a quadrant, or of previously ascertaining the index-error, as trifling and superfluous; yet, there is reason for believing that many erroneous latitudes are given from this cause, even to the present day. Captain Livingston says, "I have myself lately been witness to a master, fifty-six years of age, who has commanded many vessels, some of them of the port of London, actually observing for several days with his quadrant five minutes out of adjustment. He asked me one day to observe with it: I perceived the error, and offered to adjust it, but could hardly persuade him, as he said, 'it had not been touched by any one but himself since it was cleaned; and, therefore, could not possibly be out.' In the end, however, he allowed me to rectify it; and then, to his astonishment, found it to agree with the other quadrants on board." This is not a *solitary* case, and it is given as a general caution.

Allowing for the index-error is very preferable to being continually adjusting. Capt. Bristow has said, "I purchased my sextant of a maker distinguished by his skill, science, and integrity; and, during a practice of twelve years with it, I never turned a screw."

manders not positively knowing how to calculate the latitude, from a meridional altitude, they missed the island, and proceeded several degrees to the southward of it before the mistake was discovered. This mistake, it seems, had arisen from *subtracting*, instead of *adding*, the declination to the zenith distance, from the time it had altered its denomination. The fact was confirmed to me, (for I had heard of it before, but questioned its truth,) by one of the masters, in November, 1804, a few years after it happened.

In the preceding March, of the year last mentioned, the Santa-Anna, Moody, master, was off Norfolk Island, to the northward of New Zealand. The captain was on shore, on business, and the mate was left in charge of the vessel: the sun now crossed the line, and the ship was out of sight of land: the officer, on getting his observation, misapplied the declination; which, on the first day, produced an error in latitude of 46 miles *northerly*, by *adding* the sun's declination, instead of *subtracting* it: the next day he was full 92 miles out, &c.* The island, in consequence, could not be found; and the commanding officer, quite bewildered, got to the northward in imminent danger, unable still to form any idea of his real situation: at length, he resolved to steer to the westward, and thereby made New South-Wales. Having discovered this coast, he was fortunate enough to *guess* his error, and directed his course accordingly; and, after a most perilous cruise of six weeks, the Santa Anna got safely back to Norfolk Island. In the mean time, the captain, supposing the ship to be lost, had left the island for Port Jackson, whither his ship followed him.

When such events as these happen, can it be superfluous to simplify and illustrate the method of finding the latitude; and ought not some step to be taken for correcting the rules given in our common books of navigation, as Moore's, &c. One of these was probably the companion of the officer of the Santa Anna in his ramble.

The figure annexed is designed to exemplify this case, supposing the sun to cross the line between the 21st and 22d of March.

E.Q. Represents the equator, from which latitude is reckoned.

N.S. The meridian-line, on which it is measured.

A.B. The parallel of declination on the 21st of March.

C.D. The same on the 22d of March.

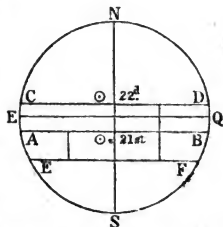
E.F. The parallel of the observer.

It appears, in this case, that, on the 21st, the space between A.B. and E.F. was the zenith distance *south*, or the sun's distance from the observer *north*; and, that the distance between E.Q. and A.B. is the declination *South*; therefore, the space between E.Q. and A.B. must be added to the space between A.B. and E.F., to give the distance between E.Q. and E.F., the latitude *south*.

On the 22d, it seems that, the distance between C.D. and E.F. is the zenith distance, or the ship's distance from the sun *South*: that the space between E.Q. and C.D. is the declination *North*. Therefore, the space between C.D. and E.Q. must be subtracted from the space between C.D. and E.F., to leave the difference between E.Q. and E.F., the latitude *South*. Instead of this, the observer added the space between E.Q. and C.D. to the zenith distance, the space between C.D. and E.F., which produced an error two-fold to the distance between E.Q. and C.D., the sun's declination.

The reverse of this was the case, in the month of September, with the four ships already mentioned.

It is always to be observed that, the zenith distance, or rather the sun's distance from the observer, or the observer's from the sun, bears a character opposite to the sun's bearing at noon. If the sun is in the zenith, or if the sun has no zenith distance, the declination is the latitude.



* Here mark the difference between March and September.

When there is no declination, the zenith distance, or distance of the sun from the observer, is the latitude of a denomination opposite to the sun's meridian bearing.*

EXAMPLES.

With the Sun bearing South.			With the Sun bearing North.		
From 90°	0'	the zenith.	From 90°	0'	the zenith.
48	57	Meridian altitude, corrected.	48	57	Meridian altitude, corrected.
41	3	Zenith distance North.	41	3	Zenith distance South.
15	1	Declination North.	15	1	Declination North.
56	4	Latitude North.	26	2	Latitude South.

ALTITUDE OF THE SUN'S LOWER LIMB.

On the last page of this work will be found, for the convenience of daily reference, a new and useful TABLE for CORRECTING the OBSERVED ALTITUDE of the Sun's LOWER LIMB, by Mr. Wm. Galbraith, of Edinburgh. The ingenious computer of it, in a letter to Dr. Brewster, one of the learned conductors of the Edinburgh Philosophical Journal, states that, it is intended to facilitate the method of correcting the observed altitude of the sun's lower limb by the fore observation at sea. It contains the joint effect of the sun's semi-diameter, dip of the horizon, refraction, and parallax, and is always to be added to the observed altitude, to find the true. In the computation of the Table, the sun's semi-diameter is taken at 16'; and its variation from this quantity, in each month of the year, is given at the bottom of the Table, which must be added to, or subtracted from, the correction found in the Table, which may be done at sight, according as the sign is + or —. It may be remarked, too, that the Table does not extend to altitudes lower than 5°, the lowest altitude at which observations can be taken, to be depended on for their accuracy. This renders all the numbers additive, except the small table of corrections for the variation of the sun's semi-diameter, which may, in most cases, unless a dip-sector is used, be neglected; since, according to the accurate observations with this instrument, by the ingenious Captain Basil Hall, much greater errors, arising from the variable state of the horizontal refraction, when this instrument is not used, are unavoidable.

EXAMPLE.

The observed altitude of the sun's lower limb, by the fore observation, is 48° 46', and height of the eye 20 feet, in the month of November; required the true altitude of the sun's centre?

8. By this Table.		2. By the usual Tables.	
Sun's obs. alt. lower limb,	48° 46'	.....	48° 46' 0
Correction to 49°, 20 feet,		Semi-diameter	+ 16 12
and November.....	+ 11	Dip.....	— 4 26
		Refraction ...	— 50
True alt.	48 57	Parallax	+ 6
		True alt. as before,	48 57 2

Hence the simplicity of our method is evident, while it obviously possesses all the requisite accuracy, since it never can deviate more than one or two tenths of a minute from the truth, and is, therefore, fully sufficient for all purposes at sea."

* For a judicious remark on the necessity of gaining the latitude by altitudes of the planets or fixed stars, when the sun is near the zenith, see the preceding part of this work, page 141.

III. OF LONGITUDE BY LUNAR AND CHRONOMETRIC OBSERVATIONS.

Captain Bristow has justly observed that, the computation of longitude, by mean of lunar distances, is one of the most grand improvements in the science of navigation : but he adds, " According to an old adage, ' nothing is so good but it may be perverted, and sometimes turned into an evil ;' so lunar observations, by being abused, have sometimes been productive of misfortune. The theory may be learnt by a school-boy ; but the practice, when lives and property are at stake, requires much skill and circumspection.

" Captain Flinders, than whom, perhaps, a more skilful navigator has not existed, says that, ' Allowing every degree of perfection to the observers and their instruments, they will probably be twelve, and may be more than thirty, minutes wrong.*' This shows how much allowance should be made in the practice. We have, undoubtedly, some lunarians so conceited, that they would be grievously offended if told that they could deviate so far from the truth. Nevertheless, to the wise caution of Flinders, I would humbly offer one of my own, which is, when error is unavoidable, always to *err on the safe side* : by this I mean that, when running for land, on the faith of a lunar observation, to be sure to be far enough a-head.

" In order to regulate this, I would recommend to every person to examine the lunar distances in the Ephemeris, and see whether more or less be requisite for that purpose, and observe accordingly. I do not mean to go upon extremes in this point ; but, if more distance be necessary to carry the ship a-head, be sure to have the limbs in contact ; and, if less, not to observe too near : this may prevent fatal errors.

" It is much to be lamented that, since chronometers have been so commonly in use, the lunars have not been so much practised as they ought to be. The two practices, when combined, assist and regulate each other ; but lunars, as the basis, should be considered indispensable ; while *Observing* may be greatly promoted by so excellent a criterion as a good time-piece, which may settle to *what limits the lunars may be trusted*, by noticing how they agree or differ, when taken within short intervals of time ; and this, allowing a small error in the rate of the watch, must be a good check from day to day. Four seconds, it is to be recollected, is only a mile, and that is a great allowance for the alteration of a rate in only twenty-four hours.

" For upwards of twenty years past, I have navigated my ship by the lunar method only. On all my passages I endeavoured to embrace every opportunity of *getting distances*, and depended on the result according to circumstances. If the sea was smooth, with fine clear weather at the time of observation, I concluded my longitude to be entitled to much confidence ; but my general allowance for error was *forty-five miles*. However, I do think that, in a thousand observations, not one in ten varied thirty miles from the truth ; and, in general, they were within ten or fifteen. My voyages have been such as have afforded me ample means of seeing how much lunars may be confided in : one to the Pacific Ocean ; three around the Globe ; two to New Zealand, and thence to the Molucca Islands ; and one to the Moluccas and Coast of New Guinea. It will appear, from the last six voyages, that I had to cross a vast tract of ocean without seeing any land ; and, as I had no opinion of a log, nor seldom used any, I navigated entirely by lunars, and have the satisfaction to say that they never deceived me."—A. B.

The Spanish Nautical Almanac, for 1820, recommends to mariners this remark—" In taking angular distances of the moon and stars, care should be taken never to allow the star to bite upon the moon's limb ; but that a clear space, which can be distinctly seen, should be kept between them, in order to hinder the scintillations of the star from confusing the eye. The writer supposes 40 seconds sufficient for this, and proposes that this should be added when the nearer limb of the moon is observed, and subtracted when the farther limb is used. The reasons seem satisfactory ; particularly as, in observing from stars East and West of the moon, the observations would not correct each other :

* See page 68 of the Tables composed by the editor of this work, and prefixed to the '*Oriental Navigator*,' quarto, 1816. The notes to these Tables include the whole of Captain Flinders' explanation of his modes of determining longitude, which should be known to every seaman.

but allowing the star to bite too close would increase the one distance, and decrease the other, having the effect of, perhaps, giving two erroneous results, which might, nevertheless, agree." These remarks are stated to be from the pen of an officer of much experience.—A. L.

IV. Remarks on ASCERTAINING LONGITUDE, and the Use of CHRONOMETERS, &c.

1. *From the Directory of Captain Horsburgh, F.R.S. Hydrographer to the East India Company.*—"Chronometers would be highly useful for the improvement of marine geography, were navigators to adopt a *uniform method*, in marking in their journals the longitude obtained by these excellent machines. In taking a departure for chronometers, at sailing from any port or headland, the longitude *allowed* to that place should be marked distinctly in every ship's journal; and the longitude measured from it by chronometers (whether East or West) to every headland, island, or danger, during the passage, ought to be carefully stated; by which means, the *relative meridians* of those places will appear to view, and be ready to compare with the admeasurement of the same by other chronometers.* But, unfortunately, the generality of navigators seldom mention in their journals the longitude allowed to the place of departure; and, instead of carrying on the longitude *made* daily from that meridian, by chronometers, they mark longitude *in*, by chronometers. The journals, therefore, are of little or no use for any future purpose, on account of the *indefinite* manner in which the longitude is marked by chronometers.

"When the longitude, obtained by lunar observations, is carried on daily by chronometers, or up to any headland, it ought also to be marked distinctly, in order to prevent any mistake.

"When lunar observations are taken, the objects on both sides of the moon ought always to be observed, if possible, and the mean taken; which will contribute to correct or modify the errors of the instrument, particularly when the distances are *nearly equal*, and fall on the *same part* of the arch of the sextant: and the difference of longitude *run by log*, between day and night observations, ought never to be applied in carrying on the one to the other, if there is a chronometer on board. If, for instance, some observations of the sun and moon are taken in the afternoon for longitude, altitudes of the sun should be taken nearly at the same time, to obtain the error of the chronometer, or what it is fast, or slow, for the apparent time at ship; having also marked down the time, by chronometer, when the distances of the sun and moon are observed, the error of chronometer must be applied to it, to reduce it to the apparent time of observation. When the observations are taken afterward by the moon and stars in the night, the time, by chronometer, ought, likewise, to be marked down: to which apply its error, and the quantity of loss or gain of the chronometer, (proportionate to its daily rate,) for the interlapsed time between these observations and those taken in the afternoon by sun and moon. The apparent time at ship, when the observations of the moon and star were taken, will then be measured by chronometer to the meridian of the place where the observations of sun and moon were taken in the afternoon, and the mean of both should be taken for the longitude of that place, after comparing the apparent time of observations with the Greenwich apparent time. By using the chronometer in this manner, the errors liable to arise from currents, and from the admeasurement of ships' run by log, *between day and night observations*, will be avoided."†

* "To shew the utility of this, the following example may be given:—In the journals of two ships, which saw the Brill Shoal and Middle Island, in the Straits of Salayer, at different times, I find they had lunar observations in both ships, which, the journals assert, may be depended upon in fixing the longitude of those places. It, nevertheless, happens, that the observations differ 20 miles; for those taken in one ship make the Brill Shoal and Middle Island 20 miles more easterly than those of the other ship: but, having chronometers on board of both ships, they *agree exactly* in measuring the difference of longitude between the Brill Shoal and Middle Island, although there is a difference of 20 miles in stating the longitudes of these places by the lunar observations."

† It is very perplexing to young navigators, that nautical time, or that used at sea, is twenty-four hours later than astronomical time; because the Nautical Almanac, and all the tables in general use, are computed for astronomical time. As the security of navigation depends upon astronomy, it certainly would be of utility to resign this *irregular prejudice*, and make nautical time conform to astronomical time.

2.—Of the wonderful improvement in the construction of chronometers, there cannot be a better testimony than the official report of the Board of Longitude, of the trial of chronometers, 1824. The annual prize, of three hundred pounds, was awarded by the Board to Mr. W. Widenham, for the best chronometer, it having varied one second and 80 hundredths of a second, on its mean daily rate, during the twelve months. The prize of two hundred pounds was awarded to Mr. J. M. French, for the second best chronometer, his having varied one second and 85 hundredths of a second, during the twelve months; 85 hundredths of a second during the last nine months, and 45 hundredths of a second during the last six months, on its mean daily rate. Mr. French's chronometer, No. 720, was made the standard, during Dr. Tiarks' operations for ascertaining the longitude of Madeira, in July and August, 1822, (noticed on page 22,) and its accuracy during the time it was under his care, induced him to take the longitude of Funchal from it. Dr. Tiarks takes the mean of the whole sixteen chronometers employed on the occasion by interpolation; and the standard gives the same result as the whole sixteen, within two hundredths of a second. Dr. Tiarks was again employed by the Admiralty, at the recommendation of the Board of Longitude, in 1823, to find, by chronometers, the differences of longitude between Dover and Falmouth, and Portsmouth and Falmouth, as shown on our page 5. His results were as follow: *Difference of time*, at Dover station, 5m. 17sec. 54 E.; Portsmouth Observatory, 4m. 24sec. 77 W.: Pendennis Castle, 20m. 10sec. 85 W.; Funchal, 1h. 7m. 39sec. 08 W. Or *Longitudes*, of the Dover station, $1^{\circ} 19' 22''$ E.: Portsmouth Observatory, $1^{\circ} 6' 11''$ W.: and Pendennis Castle $5^{\circ} 2' 42''$ W.: the difference being a little less than had been previously stated. (See page 5.)

The results are the more surprising when we consider the effects of magnetism and temperature, which so frequently disturb the rate of these valuable machines. Of magnetism, a remarkable example has lately been given in the transactions of the Royal Society of Edinburgh. Mr. Harvey, the author of the investigation, by employing a very delicate apparatus, capable of detecting the minutest traces of attraction, discovered very remarkable varieties of magnetic power in a time-keeper. On examining the balance, Mr. H. found the inner rims of the arcs of compression to be of steel, and which, together with the time-screws, were in a state of active magnetism; particularly the latter, one having strong northern polarity, and the other southern. The small wormed cylinders also, on which the thermometer pieces moved, presented equal proofs of polarity, one being a north pole, the other a south pole.—*Journal of Science*, &c. No. XXXIV.

Upon the influence of magnetism on the rates of chronometers, see, also, two papers, by Mr. Harvey, in the 19th and 20th numbers of the *Edinburgh Philosophical Journal*, which are devoted to the consideration of the changes which time-keepers undergo, by altering their positions with respect to the attracting force.

3.—THE FOLLOWING EASY METHOD of comparing the TIME indicated by any number of Chronometers, with the GIVEN time at a certain station, was published by the Rev. F. Fallows, Astronomer at the Cape of Good Hope, in 1824.

“Let a transit instrument, or even a sextant with an artificial horizon, be established in a conspicuous situation on shore, where a clock can always be regulated to true time: then provide a powerful Argand's lamp with a shutter, so as to be able to darken the lamp instantaneously: a few minutes before a certain hour in the evening, notice being previously given to the ships, let the lamp be lighted, and at the proper instant of time let it be darkened: this may be repeated several times at short known intervals. Then the errors of every chronometer on board of all the ships from which the lamp can be seen, are immediately found. After a certain number of days, let the same be repeated, when the daily *ship rates* will be given, since they are only the differences of these errors divided by the number of days elapsed between the two sets of observations. It is evident that, for greater truth, these observations may be repeated at pleasure. No objection can be made from the chronometer's being generally below deck, as one person might have his eye upon it, and another immediately above him, on the upper deck, might give a stamp with his foot the instant the lamp is darkened.”

V.—ON THE PROPER METHOD of *laying down a SHIP'S TRACK on SEA-CHARTS*; with some REMARKS on the IMPORTANCE of TIME-KEEPERS in Navigation. By Captain Basil Hall, R.N. F.R.S. Lond. and Edinb.

"THERE is no point in practical navigation of more importance, than the allowance for the direction and velocity of currents; and, although the introduction of time-keepers and lunar observations has led to much more accurate methods of making this estimate, yet there is unquestionably still much obscurity belonging to this branch of the subject: and, although it is scarcely to be hoped that we shall ever arrive at a correct knowledge of the laws which regulate the great streams of the ocean, we may certainly hope to approach much nearer than we are at present to the true state of the facts: and that we shall eventually be able, in the practice of navigation, to make much juster allowances than we now do, for the influences of these powerful agents.

Probably much of the obscurity which belongs to this subject arises from the inaccurate way in which the tracks of ships, exposed to the influence of currents, have been laid down on our charts; for the method most in use has this essential defect, namely, that, on inspecting the chart of a preceding navigator, it is rarely possible to discover where any current began, where it ceased to act, what was its direction, or what its velocity:—all essential points.

The mode proposed in this notice answers all these questions, and is quite as easy in practice as that in most general use. It is so obvious, that I cannot help being sure that it must have occurred to many practical navigators; but as I have never met with it in any treatise on navigation, and have never seen a single chart on which the tracks were so laid down, I trust this notice will not be superfluous.

The common method is as follows:—The ship's place of each day, as estimated from the log-board, is noted on the chart; and also the place, as deduced from chronometers and lunar observations. The first is called the place by dead reckoning, the other the true place. The line joining the true places at noon, is called the true track; and that joining the others is called the track or course by dead reckoning. As it happens, invariably, that these two tracks separate very early in the voyage, and never afterwards come together, unless by accident, it is obvious that, upon inspecting the chart, no information will be afforded as to the point where the current began, or where it ceased, or what was its set, or its velocity: all that we see is, two tracks wandering apart from one another; and it always requires some calculation and measurement to come at any thing like an estimate of the true effect of the current.

The tracks laid down on some of Mr. Arrowsmith's maps of the Atlantic are, on this account, altogether useless, although inserted expressly to show the effect of the current. And I speak from experience when I say, that a chart marked in this manner, whatever attention may have been paid to it by the navigator, leads only to confuse, and not to instruct.

The method which is proposed to substitute is this: let the true place be laid down each day as before, either at noon, or, which is better, at the precise moments of observation for the longitude. *Let a fresh departure be taken from every such true place, so noted in the chart; and whenever a true place is marked on the chart, let the place, by dead reckoning at that moment, estimated by log-board from the last true place, be also noted down. From each true place let two lines be drawn, one to the next true place, and the other to the dead reckoning place at the same moment.*

It will follow from this, that the true course of the ship will be one continued unbroken line; but the dead reckoning course will be a series of terminated lines running off from the successive true places. The advantages of this method are these: In the first place, it will be evident that, as long as there is no current, the true and dead-reckoning places will coincide, and there will be but one line on the chart; but the instant that a current begins to act, the true and dead reckoning places will be different, and consequently the lines will separate: and, whenever the current ceases, there will

again be but one line. These distinctions catch the attention at once : but the plan has this farther great advantage, that the line joining the dead-reckoning place and the true place, at any given hour, will express correctly the direction and the set of the current, in the interval between the moment under consideration, and the instant of the last preceding observation.*

It is useful, in practice, to have the line expressing the true course distinguished in some way from those marking the dead-reckoning courses ; one may be a strong black line, the others dotted lines ; or, when a chart is much covered with tracks, it is useful to use differently-coloured lines.

It is sometimes satisfactory to join the dead-reckoning places and the true places by arrows, and then rub out the whole of the tracks ; so that all which is essential, as far as currents are concerned, is retained ; while all that is not, and which might tend to confuse, is removed.

When one or more days elapse without an observation, the dead-reckoning track may be carried on till an observation be obtained ; and then the dead-reckoning place and the true place at that instant being noted, a knowledge of the strength and direction of the current, during the interval, is at once afforded.†

It may be said that there is a fallacy in supposing the places, as laid down from chronometers and lunar observations, to be the true places : to which I would answer, that although it is not strictly the *true* place, it is generally not far from it ; and, for all practical purposes, it may be so considered, because the object is, to ascertain the difference between the true path and the dead-reckoning path from day to day ; and it must be a very bad chronometer that will not give this within an inconsiderable quantity. Thus a chronometer, which might give the longitude half a degree wrong at the end of an Indian voyage, would serve very well to estimate the daily effect of the current off the Cape of Good Hope, within half a league of the truth.

It is clear that, to a ship navigating without a chronometer or lunars, the above method is of no avail : even if frequent lunar observations be taken, still it is not possible to make the required comparison, from day to day, without chances of great error ; whereas, by means of a chronometer, (aided as it may very readily be by lunars,) nothing is so simple.

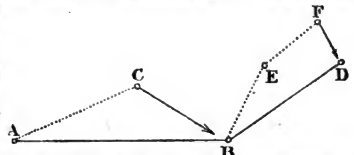
In this age of science, of general intelligence, and of liberality in every thing connected with mercantile enterprise, it is indeed most astonishing that any ship should ever be permitted to set out on a voyage without a chronometer : and owners of ships, independently of the fearful responsibility which they incur by neglecting so important a precaution, may be assured that they most materially neglect their own interest by this species of economy ; for the safety of a ship is not only greatly lessened, but the voyage, in nine cases in ten, materially protracted by the want of this easy and cheap addition to her equipment. Not only, therefore, the high obligation which they are under, to preserve, as far as in them lies, the lives of people embarked in their service, but their own obvious pecuniary advantage, calls upon them to despise this paltry saving, and never to suffer one of their ships to leave port without being provided with an instrument often of as much value as either sails or rudder.

* EXAMPLE.—Let the ship's true place, on the first day, be assumed, as at A. Let a fresh departure be thence taken, and the next true place, or place by observation, be noted, as B. Let the ship's place by dead-reckoning be noted at the same moment, as at C.

From the true place, (A,) let the two lines be drawn, as A B and A C.

The difference, C B, thus shows the error in dead-reckoning, which may be the effect of current.

From B, the ship's true place on the second day, the ship's true place on the fourth day may have changed to D ; while E represents her place by dead-reckoning on the third, and F on the fourth, day, &c.—EDITOR.



† This paper was originally communicated to the public through the medium of the '*Edinburgh Philosophical Journal*.' For a plate to illustrate the facts which it describes, see the Second Volume of that valuable Work, page 279.

The class of navigators and ship-owners, who, not many years ago, held scientific navigation in contempt, is now happily much reduced. On such persons well-established facts have more influence than any general reasonings or assertions; and I beg leave to call their attention to the following circumstances, which actually fell under my own observation.

In May, 1815, in his Majesty's sloop *Victor*, I arrived off the Cape of Good Hope, in company with a fleet of Indiamen, all of which were, of course, amply provided with excellent time-keepers. The *Arniston*, a large ship, and formerly an East-Indiaman, was also in company. She had been sent with troops to the Island of Ceylon, and was now returning with invalids, to the number of several hundred, together with upwards of fifty women and children. From what circumstance, whether of ignorance, or mistaken and most culpable economy, I do not know, this ship was unprovided with a time-keeper, and therefore, though commanded by an active and intelligent seaman, she was not, owing to this single omission, at all in a condition to approach this coast, especially at such a stormy season, when lunar observations were scarcely to be hoped for, and when the current was most violent and irregular.

It was the daily practice to telegraph the longitude to the *Arniston*; and, as long as the fleet kept together, no disadvantage was experienced by her having no chronometer. But we had scarcely reached the eastern edge of the Bank of Lagullas, when a violent gale scattered the ships in different directions, and the unfortunate *Arniston* was left to shift for herself. The ships were exposed to a variety of currents, from the 18th to the 28th of May: in this interval we had, moreover, three heavy gales of wind; from which it will be obvious, that, by dead-reckoning alone, it was altogether impossible to tell the situation of the ship. In fact, on board the *Victor*, I found that, after making every allowance for currents, which the experience of others on this well-known ground entitled me to use, the dead-reckoning was still upwards of 100 miles from the truth. But, after all, these observations are a mere guess.

Meanwhile, the commander of the *Arniston*, after making every possible allowance, conceived, at the end of ten or twelve days, that he must have passed to the westward of the Cape of Good Hope, by a very considerable distance, and without hesitation bore up with a south-easterly gale of wind, and steered, as he thought, for St. Helena. He had not proceeded, however, many hours, before the land was discovered a-head, and on each bow: they were embayed, in short, a hundred miles east of the Cape; and, though they let go their anchors, and cut away their masts, the gale drove them on the coast; and of the whole crew, soldiers, women, and children, only four or five sailors reached the shore alive!*

In order to prove that this ship was lost from want of a time-keeper, it is only necessary to state the following facts, which will be conclusive with every practical navigator.

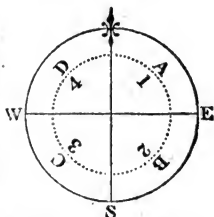
By means of good time-keepers, I found that his Majesty's sloop *Victor*, during the interval above mentioned, was carried by the current 186 miles to the westward, and 72 miles to the eastward, making an aggregate of 114 miles, or $2^{\circ} 18'$ of westing more than the dead-reckoning. Now, it would have been a moderate allowance for the effect of the Cape current, under all the circumstances of the case, to have supposed the ship to be set to the westward in eleven days at least 220 miles, or 106 miles more than the ship was actually set: so that, after the commander of the *Arniston* had made all the usual allowances, he would still have estimated his place wrongly, by at least 106 miles, or $2^{\circ} 8'$ of longitude; an error five times greater than the worst chronometer I have ever seen in use, would have given in so short an interval. It thus becomes certain, that, when the *Arniston* was, by dead-reckoning, after full allowance had been made for current, apparently many miles west of the Cape, she was in fact a very long way east of it. And the important circumstance to be borne in mind is, that, had this ship been provided with a very ordinary chronometer, she would, according to every principle of navigation, most assuredly not have been wrecked."

* It has been asked, by an intelligent friend, whether, by *sounding* in time, the *Arniston* might not have been saved?

VI.—BRIEF MODE OF EXPRESSING THE POINTS OF THE COMPASS.

THE Spanish navigators, in describing courses, &c., commonly make use of the expression, '*Rhumbs of the first, second, third, and fourth, quadrant,*' or winds of the same. The first quadrant, in this expression, is that contained between *North* and *East*; the second, from *East* to *South*; the third, from *South* to *West*; and, the fourth, from *West* to *North*.

The respective quadrants may be represented algebraically by the letters A, B, C, D, as in the annexed figure: and, in keeping a journal, the points of the compass, or courses and bearings, may be expressed briefly, by adopting these letters as the representatives of the four quadrants: thus, N.W. by W. $\frac{3}{4}$ W., or five points and three quarters from the North towards the West, will be concisely expressed by D $5\frac{3}{4}$; N.E. will be A 4; S.E. by E., B 5; and S.W. by S., C 3; &c.



So, likewise, by reckoning in degrees of the quadrant, N. 50° E., will be A 50° ; and, in allowing for magnetic variation, say 24° W.; this added will be A 74° , the compass bearing, &c. Should a true bearing be N. 76° E., adding 24° the variation, will give 100° : deduct 90° , and this gives E. 10° S. or S. 80° E., or B. 80° , the bearing by compass.

But, that the figures for Points may never be mistaken for degrees, it may, perhaps, be best to express the latter in the usual manner, as N. 50° E.

VII.—GENERAL REMARKS ON THE MAGNETIC VARIATION AND ABERRATION.

IN order that the subsequent Remarks may be clearly understood by *every one* of our readers, it becomes necessary to explain, in the first instance, the meaning of *magnetic dip*, or *dip of the needle*.

THE DIP OF THE NEEDLE is a certain degree of inclination, towards the earth, which it acquires with the magnetic virtue. This wonderful property was first observed by our countryman, Robert Norman, a maker of compasses, about the close of the sixteenth century; and instruments have since been constructed for ascertaining the inclination, or quantity of *dip*, in different parts of the earth.

The general phenomena of the *Dipping-Needle* are, that, at a certain distance from the equator, either north or south, it varies but little from an horizontal position, but depresses one end on receding either way from that parallel; the north end when nearer to the north pole, and the south end when nearer to the south pole: so that the farther north or south that we go, the inclination becomes the greater. At London, in the year 1592, the dip of the north end of the needle was given as $71^{\circ} 50'$ below the horizon; in the year 1805, as $70^{\circ} 21'$. At Paris, in 1812, it was $68^{\circ} 42'$.

The extreme delicacy of the instrument employed, and the great care requisite in taking the observations, have impeded our knowledge of the exact dip in different parts of the earth: but the following are probably the results of the best observations that have been made on the face of the Atlantic, &c.

	°	'		°	'	
In Baffin's Bay.....	Lat. 76	8	Dip, 85	59½	S. Voyage of Capt. Ross, 1818.	
Spitzbergen	79	45	82	0	— Voyage of Capt. Buchan, 1818.	
London	51	30	70	21	— Royal Society, 1805.	
Paris	48	50	68	42	— Institute of France, 1812.	

Atlantic Ocean.

In Lat.	38	52 N.	Long. 14	2 W.	Dip, 45	45
	37	26 —	14	12 —	45	21
	34	30 —	14	35 —	43	48
	31	46 —	14	44 —	43	30
	28	28 —	16	13 —	41	45
	24	53 —	18	38 —	40	48
	21	29 —	23	22 —	39	3
	19	54 —	26	25 —	38	19
	14	15 —	45	43 —	33	54
	13	2 —	50	55 —	30	40
	11	1 —	52	31 —	28	15
	10	46 —	58	34 —	28	9
	11	2 —	19	38 —	20	0
	0	50 —	15	11 —	18	0
	0	11 —	16	13 —	17	0
	0	42 S.	16	52 —	17	0
	1	43 —	17	21 —	16	0
	5	37 —	19	22 —	10	30
	6	50 —	19	52 —	8	30
	8	5 —	20	41 —	7	0
	9	26 —	21	19 —	3	30
	10	57 —	23	0 —	0	0

M. de Humboldt, on his Voyage of 1799. For particulars, see his *Personal Narrative*, English translation, Vol. II. p. 117.

Ship Boussole, under M. de la Pérouse, 1785: but those of the Astrolabe, under the same commander, varied from these very considerably.

In the diagram annexed, H O represents the horizon; *a, b*, the magnetic dip at London, 70° ; *c, d*, that on the equator, 17° ; and *e, f*, that in Baffin's Bay, equal to 86° nearly.

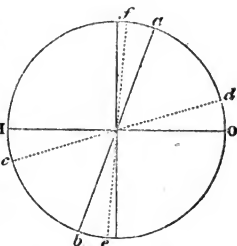
We give the preceding table, &c., merely to illustrate the definition. Few merchant-ships have a Dipping-Needle, and the commanders of those which have, will seek for information on this subject in other sources. We, therefore, turn to the *Variation of the Compass*.

The present state of the magnetic variation has become a subject of peculiar and curious enquiry to the navigator and philosopher. We have shown, in a former work, the "Sailing Directions which accompany the Large Chart of the English Channel," the state of the Variation at London, as ascertained at different periods, from the year 1580, when it was $11^{\circ} 15'$ East, to the middle of 1824, when it was $24^{\circ} 9' 33''$ West; and, in another work, the "Memoir to accompany the General Chart of the Northern Ocean," &c., we have shown its recent state around the Coasts of Great Britain, and on those of the Greenland Seas, Baffin's Bay, Hudson's Bay, &c.

Should, however, the reader of this work not have those above mentioned to refer to, it may be necessary to repeat a few remarks already made; and it is, of course, requisite to add such others as are peculiarly adapted to the navigation of the Atlantic.

The existing variations of the needle, on the different coasts of this Sea, may be readily known by referring to the last paragraph of Notes, attached to the respective divisions of the Tables of Positions, in the former part of this work. We have also shown, upon the face of the Chart, the variation on the ocean, remote from land: and, although many of the observations were made some years ago, there is reason for believing that they deviate but very little from the truth at the present time.*

* We have had reason to wish that our Notes on the Variation had been more generally known. In a respectable Review of Books, which has long been celebrated for its general display of knowledge and liberal opinions, we find the following passage, written in the year 1820. "According to a Chart of the Variations, by Bellin, a very celebrated engineer, the needle continues steadfast at 20° of westerly variation during the whole of a direct course from Bristol, across the Atlantic, to Boston, in North-America; a distance of about 4800 miles: but, in the minor distance from Boston to Cape Florida, about 1100 miles, a variation of 23° occurs." A reference to our Tables will show that the present variation at or near Bristol is not less than 25° West; at St. John's, Newfoundland, 26° West; but, at Boston, only 7° West; and, at Cape Florida, about 5° East. The latter, it is to be recollected, are not deduced from any theory or hypothesis, but from actual



It is now well known, from many observations made at London, Petersburg, St. Helena, and other places, that the magnetic needle has a diurnal, as well as an annual, variation: and that, from about eight o'clock in the morning, the magnetic needle verges to the west, until about two o'clock in the afternoon. When it has attained its greatest westerly variation, it gradually returns to the east, until about eight or nine o'clock in the evening, when it becomes stationary until the next morning. Thus, in the most regular state of the magnetic needle, it is constantly subject to two variations, an annual and a diurnal one; and it is also subject to an *aberration*, arising from the state of the atmosphere, humidity, lightning, local attraction, &c.

The westerly variation has been decreasing for many years past in Canada and the Northern parts of the United States of America; but, in the West Indies, there seems to have been no sensible change for a long period; and it appears to be, at length, determined, that the westerly variation has reached its maximum in Europe, and is now on the decrease.

From a series of astronomic and magnetic observations, made by *Colonel Mark Beaufoy*, at Hackney Wick, near London, (on the East,) in May, 1813, the greatest variation was observed, on the 3d of that month, and appeared to be $24^{\circ} 26' 20''$. At 8h. 50m. in the morning of that day, it was only $24^{\circ} 9' 45''$, and continued to increase until 35 minutes past two; at which time there was a *great deal of thunder in the west*; but, on the next day, when there was thunder in the East, the variation amounted only to $24^{\circ} 16' 30''$, the difference being $9' 50''$.

The mean of the morning, noon, and evening, observations, taken by the same ingenious officer, on fifteen days of the same month, was as follows:—*Morning*, $24^{\circ} 11' 15''$; *Noon*, $24^{\circ} 20' 55''$; *Evening*, $24^{\circ} 15' 54''$. The latter may be considered as near the general mean. The mean variation, at the three periods of observing, for two years, 1814 and 1815, has been given as follows:—*Morning*, $24^{\circ} 14' 39''$; *Noon*, $24^{\circ} 21' 54''$; *Evening*, $24^{\circ} 16' 4\frac{1}{2}''$.

The observations of *Colonel Beaufoy* have been regularly continued; and his statement, August, 1817, to October, 1819, may be seen in our "*Memoir on the Northern Ocean*," page 3. A subsequent statement to March, 1820, follows:—

		1818.			1819.			1820.		
		°	'	"	°	'	"	°	'	"
November.	Morning..	24	33	24	24	32	42			
	Noon	24	41	41	24	38	43			
	Evening ..	—	—	—	—	—	—			
December.	Morning..	24	37	4	24	33	29			
	Noon	24	41	20	24	37	20			
	Evening ..	—	—	—	—	—	—			
January.	Morning..	24	34	2	24	35	42	24	34	6
	Noon	24	39	57	24	39	54	24	37	54
	Evening ..	—	—	—	—	—	—	—	—	—
February.	Morning..	24	34	22	24	34	17	24	32	19
	Noon	24	40	51	24	39	55	24	38	7
	Evening ..	—	—	—	—	—	—	—	—	—
March.	Morning..	24	33	18	24	33	18	24	30	47
	Noon	24	41	37	24	41	42	24	39	33
	Evening ..	24	33	47	24	35	17	24	33	45

The mean variation, in the month of September, 1820, as found by *Colonel Beaufoy*, was, *Morning*, $24^{\circ} 31' 16''$; *Noon*, $24^{\circ} 40' 29''$; *Evening*, $24^{\circ} 32' 59''$.

These observations were made at Bushy Heath, Stanmore, about ten miles N.W. from London, where it appears that the maximum of western variation occurred about the month of March, 1819, since which time it has decreased. *Colonel Beaufoy* adds, "It is on record that, in 1658, the compass pointed to the true north: the western variation has, therefore, been increasing for 162 years, and is now retrograde; but what is the limit of the eastern declination, remains to be determined; as I cannot find any observations on the variation of the compass prior to 1580, at which time it was $11^{\circ} 15'$ East." From observations made by the Royal Society, at Somerset Place, in London, in 1821, the mean variation here appeared to be only $24^{\circ} 11' 18''$; in 1822, $24^{\circ} 9' 55''$; in 1823, $24^{\circ} 9' 48''$; in 1824 (to Midsummer), $24^{\circ} 9' 33''$.

The ABERRATION of the COMPASS is its deviation from the magnetic meridian, which may be caused, as already noticed, from a peculiar state of the atmosphere, aurora-borealis, lightning, or the local attraction of the ship, iron, &c. The aberration is a new subject of enquiry, which was first explained by Captain Flinders, in the description of his Surveys of the Australian coast. To this subject his attention was directed, not only by some anomalous differences which he found in the compasses that he used, but by others recorded by Mr. Wales, who had accompanied Captain Cook, in the capacity of Astronomer.

Mr. Wales, in the Introduction to his Astronomical Tables, at the end of the voyage, remarks, "In the English Channel, the extremes of the observed variation were from $19\frac{1}{2}$ to 25° ; and, all the way to the Cape of Good Hope, I frequently observed differences nearly as great, without being able any way to account for them, *the difference in the situation being by no means sufficient*. These irregularities continued after leaving the Cape, which at length put me on examining into the circumstances under which they were made. In the examination, it soon appeared that, when most of these observations were made, wherein the greatest west variation had happened, *the ship's head was north and easterly*; and that, when those, where it was least, had been observed, it was *south and westerly*. I mentioned this to Captain Cook and some of the officers, who did not, at first, seem to think much of it; but, as opportunities happened, some observations were made under those circumstances, and very much contributed to confirm my suspicions; and, throughout the whole voyage, I had reason to believe that, variations observed with the *ship's head in different positions, and even in different parts of her, will differ very materially from one another*; and much more will observations observed on board different ships, which I now find fully verified, on comparing those made on board the Adventure, with my own made about the same time in the Resolution."

Captain Flinders says, "Several instances have been mentioned, in the course of this voyage, where the compass showed a different variation on being removed from one part of the ship to another; thus, observations on the binnacle gave $29\frac{1}{2}^{\circ}$ off the Start, where the true variation was about $25\frac{1}{2}^{\circ}$ West; while others taken upon the booms, before the main-mast, 68 miles lower down channel, gave only 24° ; and, in experiments made with five compasses, the mean variation at the binnacle was $4^{\circ} 37'$ greater than on the booms. Finding that the situation of the compass was an object of importance, I determined very early in the voyage to place it always upon the binnacle, both when taking bearings for the survey, and when observing azimuths or amplitudes; nor, in any observations taken by myself, was it ever displaced except by way of experiment: but the officers occasionally observed from different parts of the ship, when the sun could not be seen from the binnacle, until they were convinced that such observations were of no utility, either to the survey, or for ascertaining the true variation.

It soon became evident, however, that keeping the compass to one spot was not sufficient alone to insure accuracy; a change in the direction of the ship's head was also found to make a difference in the needle; and it was necessary to ascertain the nature and proportional quantity of this difference before a remedy could be applied. This inquiry was attended with many difficulties, and no satisfactory conclusion could be drawn until a great variety of observations were collected: it then appeared that, when the ship's head was on the eastern side of the meridian, the differences were mostly one way, and when on the western side they were the contrary; whence I judged that the iron in the ship had an attraction on the needle, and drew it forward: but there was this remarkable distinction in the northern hemisphere, it was the north end of the needle which was attracted, and, in the southern hemisphere, it was the south end. In the instance off the Start, before cited, when the ship's head was West, the North end of the needle had been drawn forward, or to the left of North, nearly 4 degrees, and the West variation thereby increased to $29\frac{1}{2}^{\circ}$; with the head East, it would be drawn to the right of its natural position, and the variation diminished to about $21\frac{1}{2}^{\circ}$; but, at North, the attraction in the ship was in the same line with the magnetic poles of the earth, and would therefore produce no change. The same thing took place at South, for the two attractions were still in the same continued line, though on opposite sides of the compass; and, throughout the voyage, I found that variations taken with the head at North and South, agreed very nearly in themselves, and with the observations on shore, near the same place, when such observations were not affected by local attractions.

But, although the errors were always the same way in the same hemisphere when

the head was at West, and when it was East they were always the contrary, yet the quantities varied with the situation of the ship, being greater in high and less in low latitudes; and yet they did not increase and diminish in proportion to the latitude. After much examination and comparison of the observations, and some thinking on the subject, I found that the errors had a close connexion with the *dip of the needle*. When the North end of the needle had dipped, it was the North point of the compass which had been attracted by the iron in the ship; and, as that dip diminished, so had the attraction, until, at the magnetic equator, where the dipping-needle stands horizontal; there seemed to be no attraction. After passing some distance into the southern hemisphere, and the south end of the needle dipped, our observations again showed errors in the compass; but the West variation was now too great when the ship's head was eastward. These errors increased as the dip augmented: and, in Bass' Strait, where the South dip is nearly as great as the North dip in the English Channel, the attraction produced almost as much error as when we left England: but it was of an opposite nature. On turning northward again, along the East coast of New South-Wales, the dip of the South end of the needle, and the attraction of the iron upon the South point of the compass, diminished together, as nearly in equal proportions as the accuracy of our observed variations could be depended on; and I, therefore, considered the connexion between them to be so far certain, as to make the dip one *datum* in reducing the observed to the true variations.

Another point of equal importance remained to be known: the compass stood right in both hemispheres when the ship's head was at North or South, and erred most to one side when the head was West, and on the other when it was at East; but what was the proportion at the intermediate points, between the magnetic meridian and East and West? Unfortunately, the direction of the ship's head, when observations were taken, had not been particularly marked in the first part of the voyage, nor always in the latter part; and, in gathering it from the courses steered, when under way, and from the direction of the winds and tides when at anchor, there was often a good deal of uncertainty; but, it was evident that, the quantity of error increased as the angle between the ship's head and the magnetic meridian became greater. After some consideration, it appeared to me, that the magnetism of the earth, and the attraction forward in the ship, must act upon the needle in the nature of a compound force; and that the errors produced by attraction should be proportionate to the *sines* of the angles between the ship's head, and the magnetic meridian. I tried this upon many observations, where the direction of the head was least doubtful, and found the differences to correspond as nearly as could be expected, and sometimes exactly; it, therefore, seemed probable that *the error produced, at any direction of the ship's head, would be to the error at East or West, at the same dip, as the sine of the angle between the ship's head and magnetic meridian, was to the sine of eight points, or radius*. According to this, when the error was ascertained at any given direction, more especially at East or West, where it was greatest, it might be found at any direction required, by inspection in the Traverse Table.

Soon after my arrival in England, application was made to the Lords Commissioners of the Admiralty to have experiments tried on board some of his Majesty's ships, that this law might be verified; and they were pleased to order them at Sheerness, Portsmouth, and Plymouth. I was present at the first two ports, when a series of observations were made in five different vessels; and the general results, so far as they are necessary to the present explanation, were these:

1st. At or near the binnacle, the north point of the compass was attracted forward in all the ships; but the quantity of error produced on one side when the head was East, and on the other when West, varied from $6\frac{1}{2}$ to $0^{\circ} 21'$.

2d. When the compass was placed in other parts of the different ships, the attraction was sometimes forward, and sometimes aft; but always aft from the forecable. The error at some of the stations was greater than at the binnacle, and at others less.

3d. The errors were least when the ship's head was at, or near to, North or South, and greatest at, or near to, East or West; and, as the head was made to deviate from the points of least error towards the greatest, the increase of error was found to be in proportion to the sines of the angles of deviation [aberration].

The last was the particular subject of my anxiety; and, being then satisfied that the law, before deduced from analogy, was certain, I employed it to find a standard correction for all my observations in the Investigator. For this purpose a selection of them

was made where the ship's head was in the most opposite points, and farthest from the meridian, and where the true variation could be ascertained within a small quantity; the difference between the observed and true variations gave the errors; and, when the head had not been East or West, they were proportioned to eight points, or radius, by the sines of the angles. These observations were collected into Tables, one for the northern, and another for the southern, magnetic hemisphere, and classed according to the dips of the needle; and the error, for eight points, at each dip, being reduced to parts of that dip, a medium of the whole was taken, and considered to be the standard radius applicable to all situations."—*Flinders' Appendix*, vol. ii. 512 to 515.

Captain Flinders notices the preceding remarks made by Mr. Wales, and he adds, "Mr. Wales did not quit the subject here. In the Introduction to Captain Cook's Third Voyage, published in 1785, is a paper from the same careful observer, citing a variety of cases wherein differences were found in the variation of the compass. These cases are as follow:

- 1st. Putting the ship's head a contrary way: differences 3° to 6° , and even 10° .
- 2d. At different times of the same day: differences 3° to 7° .
- 3d. Being under sail, and at anchor in a roadstead: difference 5° .
- 4th. On board different ships: differences 3° to 5° .
- 5th. Near the same place, at different times in the voyage: 4 and 5° , or upwards.
- 6th. In different compasses: 3° to 6° .

"That the variation should be different on changing the direction of the ship's head, or the place of the compass, and also on board different ships, is perfectly reconcilable to the explanation I have given; but that it should vary so much at different times of the same day or year, when under sail and at anchor, or even in different compasses, much surprised me, if all other circumstances were the same. I was, therefore, induced to examine the instances quoted under each case; and found great reason to believe, not only that the direction of the head was changed in most, if not all of those where great differences had been observed; but, also, that the differences themselves were conformable to what had taken place upon the binnacle of the Investigator.

"Mr. Wales goes on to observe, 'It is not necessary to account for these differences in the observed variations in this place, nor yet to point out the reasons why such anomalies have not been noticed in observations of this kind before. I shall, however, remark that, I have hinted at some of the causes in my introduction to the observations which were made in Captain Cook's Second Voyage; and many others will readily offer themselves to persons who have had much practice in making these observations, and who have attentively considered the principles upon which the instruments are constructed, and the manner in which they are fabricated. Nor is it at all surprising that the errors to which the instruments and observations of this kind are liable, should not have been discovered before; since no navigators before us ever gave the same opportunity, by multiplying their observations; and making them under such a variety of circumstances as we did.'

"That the compasses, even in the Royal Navy, and to this day, are the worst constructed instruments of any carried to sea, and often kept in a way to deteriorate, rather than to improve, their magnetism, cannot be denied: but errors, arising from the badness of compasses, would not be reducible to regular laws, as those were in the Investigator, and appeared to be in the three ships commanded by Capt. Cook. It seems, indeed, extraordinary that, with the attention paid by Mr. Wales to the subject, he should not have discovered, or suspected, that the attraction of the iron in the ship was the primary and general cause of the differences so frequently observed; nor have perceived that the differences varied proportionally to the direction of the ship's head and to the dip of the needle, and were of an opposite nature in the two hemispheres.

"It appears that differences, probably similar to those in the Investigator, were also observed on board *La Recherche*, one of the ships with which the French Admiral d'Entrecasteaux went in search of the unfortunate *La Pérouse*. M. Beautemps-Beaupré, the able surveyor to the expedition, found so much uncertainty in compass-bearings, that he abandoned, as far as was possible, the use of them; substituting the sun's azimuth and

and angular distance from some one point, and measuring the angles from that point to other objects. He says of the compass, "We found by a great number of observations, but principally by the differences between the bearings of points set with each other from opposite directions, that no confidence could be had in bearings taken with the compass from the deck of a large vessel, nearer than to 3° , even under the most favourable circumstances. For instance, it has often happened that, from one position, as C, the cape A has been set in a line with cape B; and, afterwards, from another position, D, cape B has been set with A; and that we have found considerable differences in the results of the two observations.* We also remarked that the compasses showed differences of several degrees in variations at sea, though observed with the greatest care and within the space of a few minutes.

"I do not find any other distinct mention of differences found in the variation, from changing the direction of the ship's head, or the place of the compass; but it appears from the following extract that, the Investigator was not singular in having a variation of four degrees greater than the truth in the English Channel. Captain Vancouver, in his passage towards Madeira, says (vol. i. p. 6.), 'The error in reckoning, amounting almost to a degree (of longitude), seemed most likely to have been occasioned by our not having made sufficient allowance for the variation of the compass on our first sailing; as, instead of allowing from 22 to 25° , which was what we esteemed the variation, our observations for ascertaining this fact, when the ship was sufficiently steady, showed the variation to be 28° and $29\frac{1}{2}^{\circ}$ westwardly.'

"Besides the errors which the attraction of the iron produced in the compasses at the binnacle of the Investigator, differences are frequently mentioned in the course of this voyage as having been found in the magnetic needle on shore, and on board the ship in the vicinity of land. That there are few masses of stone totally devoid of iron; and that all iron, which has long remained in the same position, will acquire magnetism, or a power of attracting one end of the magnetic needle towards one part of it, and the opposite end towards another, is, I believe, generally admitted. The kinds of stone which I have observed to exert the greatest influence on the needle, are iron ore, porphyry, granite, and basaltes; and the least are, sand or free-stone and calcareous rock, and the argillaceous earth, very little."—*Flinders' Appendix*, vol. ii. 523 to 526.

The iron in the ship, attracted the south end of the needle in the southern hemisphere; and in the same part of the world, it was the same end of the needle upon which the land had an attraction.

DEDUCTIONS FROM THE EXPERIMENTS made by CAPTAIN FLINDERS.

1st. On board most ships, more especially of war, the iron-work, guns, shot, &c., possess magnetic powers; out of which a compass cannot be placed any where within the ship; and, if it is placed at a short distance out of the ship, the effect upon it will be even greater than in most parts on board.

2d. In England, and probably in all parts of the northern magnetic hemisphere, the effect of these various influences is, generally, to draw the North point of the needle towards the bodies whence the influences emanate, and to repulse the South point from them.

3d. The power of each body to alter the direction of the needle depends upon the four following particulars: First, the strength of the magnetic virtue in that body. Second, its direction, with respect to the horizontal level in which the needle traverses. Third, its distance from the compass: and, fourth, the angle which its bearing makes with the magnetic meridian. Of these, the last three may be changed, by altering the place of the compass, without any motion of the ship, and the last may be changed by altering the direction of the ship's head.

4th. The effect produced upon the compass is the combined result of all the attractions in the ship. If those in one direction be superior to the others, the needle will be

* In the sketch given for elucidation, the ship, at the position C, is represented to be steering S.W., and, at the position D, N. by E.; hence, probably, the difference of bearing.

drawn in that way. If those in two directions be superior to all others, but equal in themselves, the needle will be drawn towards a line passing between them; but, if the attractions be equal in all directions; it will suffer no derangement, but remain in the magnetic meridian.

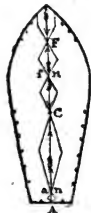
5th. Were all the iron in a ship confined to the sides, and equally distributed, a needle in the midship line would be always attracted forward when placed abaft the centre; and always attracted aft, when before the centre. But there are three parts, more particularly, where considerable quantities of iron are placed in or near the midship line; and these interfere with the lateral attractions, by counteracting their combined effect in some situations of the compass, and strengthening it in others. About the stern, bows, foremast, and under the forecastle, there is much iron near the midship line, and some round the mainmast. Towards one of these three situations, if the lateral attractions be equal, a needle in the midship line will always tend, with some exceptions. For the advantage of explanation, call the three attracting situations, individually, the *foremost*, *central*, and *aftermost*, attractions; and, generally, the *midship attractions*. The intermediate stations, where these attractions neutralize each other, call *neutral stations*.

6th. When the midship attractions and the lateral attractions are equal, there will be no alteration made in the needle at any part of the midship line, when the ship's head is in the magnetic meridian, either at North or South. These are then the *points of no difference*: but, if the midship attractions lie to either side, or the lateral attractions be unequal, the points of no difference will not be at North or South, but at those directions where the head must be, to bring the mean of the attractions to lie North or South from the compass. Thus, if the mean attraction lie forward 10° from the midship line to the starboard side, the points of no difference will be N. 10° W. and S. 10° E., when the attraction will lie in the magnetic meridian, and no change be produced in the needle. And, if the attraction lie aft, 10° over to the same side, the points of no difference will be N. 10° E. and S. 10° W.

7th. The directions of the ship's head, at which the greatest differences will be produced by the attraction of the ship, are at right angles to the points of no difference. At the intermediate points, the differences will be proportionate to the greatest difference, as is the *sine of the angle of deviation from the points of no difference, to radius*.

8th. The stations most important to be known, are the *neutral stations*; where the needle, being equally affected by the attractions forward and aft, remains true. The foremost station usually lies at a little more than half way from the main, towards the fore, mast; and the aftermost neutral station very close to the stern.

9th. Neither the exact places of the midship attractions, nor of the neutral stations, can be known without experiment made in each ship: nor otherwise can it be known what are the points of no difference; what will be the greatest difference; nor even, which way the needle will be certainly attracted: so varied is the magnetism in different vessels. The points of no difference, however, are most usually North and South, or very near them. The annexed small figure will shew the most regular course of the attractions on the upper deck of a ship of war.



F. The foremost attraction near the foremast.

C. The central attraction near the mainmast.

A. The aftermost attraction close to the stern.

f. n. The foremost neutral station.

a. n. The aftermost neutral station. The arrows shew the attraction forward, or aft: and the diamond-like squares shew the relative quantity of difference produced in the needle along the midship's line.

10th. The mean of two bearings, or variations taken with the ship's head at any two opposite directions, or at any equal number of degrees from the points of no difference, will be the correct bearing or variation, so far as the compass can be depended on, and the observations are well taken.

11th. The strength of the magnetic virtue in the iron on board a ship depends upon the situation of the ship, with respect to the magnetic poles of the earth. That, when the ship is nearest to the North Pole, the iron, in general, attracts the North end of the needle; and the more strongly, as the ship approaches nearer the pole. When the

the ship is in the southern magnetic hemisphere, the iron attracts the South end of the needle; and the degree of its strength is proportionate to the greater vicinity of the ship to this pole, than to that of the opposite hemisphere. At the magnetic equator, where the difference of the two poles is equal, or nearly so, and their powers balanced, the iron does not attract either end of the needle in preference.

12th. The dip of the needle being produced by the same cause which gives magnetism to the iron in a ship, will serve as a measure for the relative force of that magnetism, and for the differences produced by it in a compass at different parts of the earth. Thus, in changing a ship's head from North to East, if a difference of 4° to the right is found in the English Channel, where the dip is about 72° N. At another place, where the dip is 36° N., the difference, from an equal change in the head, should be 2° the same way, provided the place of the compass be the same, and the iron be unchanged. At 36° dip of the South end of the needle, the difference should also be 2° , under the same circumstances; but to the left instead of the right.

Mr. Bain, in his "*Essay on the Variation of the Compass*,"* has added many observations to those of Captain Flinders, and has examined the fatal consequence that must, at times, arise to navigators who neglect so important a datum in their reckoning as that which is here pointed out; and which, according to the author's observations, made with the greatest care and attention, will amount, in many cases, to 10 or 12 degrees: that is, the variation of the compass, with the ship's head at East, will appear to be 22° or 23° ; and, with the ship's head at West, the variation will be found 32° or 33° : so that, on either of these courses, the ship will be steering 5° too much to the East or to the West. The fatal consequence that may ensue from such an error in the reckoning will be sufficiently obvious.

Captain Ross, in his late voyage to Baffin's Bay, has given some striking illustrations of the aberration of the compass. This gentleman says that, when the variation is great, the aberration, which is *more or less in every ship*, will increase in no settled proportion, but will be governed by so many causes, that no surer method of ascertaining the course really steered can be adopted than that of determining the actual variation of the time, according to the course in which the ship is steered.

In alluding to the origin of observations on the Aberration, Captain Ross observes that it was reserved for Captain Flinders to elucidate this interesting fact; "to lay down a rule for correcting the error of variation, occasioned by changing the ship's head, which, under the circumstances, and within the limits of his observation and experience, were probably legitimate and correct. But the principle on which this rule is founded, will not be found applicable to every circumstance, and to all situations, and particularly where it has now been put to the test, in Baffin's Bay. He adds that, the experiments made after the return of Captain Flinders, gave some insight into the cause of aberration, but were insufficient to explain them perfectly; and this Captain Ross has most fully proved by his experience on the voyage, during which, every possible opportunity was embraced, by taking observations, and making all the necessary experiments and comparisons.

The enormous quantity of Variation and Aberration found in the Northern Seas, is described in our Memoir on the Northern Ocean, pages 6 and 7. Captain Ross's deductions, from various experiments, are as follow:—

1st, That there is a *point of change*† in the aberration, occasioned by the attraction of the ship.

2d, That the point of change is not the magnetic north, but *near* it, in the ship *Isabella*.

3d, That it varies in different ships, and is affected by increase or decrease of variation, by proximity to land, or to another ship.

4th, That the point of change may be found by azimuth, or by the bearing of a distant object, situated near the magnetic north, or in any other direction, if that cannot be had.

* See our '*Memoir on the Northern Ocean*,' &c. page 4.

† The POINT OF CHANGE is the point on which there is the least deviation, or aberration, from the correct magnetic bearing.

The rule, therefore, is,

Take an azimuth, or the bearing of a very distant object by the azimuth compass, with the ship's head at different points, East and West of North, until the points of least and greatest aberration are found; the mean of these will be, nearly, the point of change.

The several facts collected from all the experiments made at different times during the Expedition to Baffin's Bay, 1818, were as follow :

1. That every ship has an individual attraction, which affects the compasses on board her : and, to ascertain the exact quantity of its effect, though possible, requires the most particular care and the nicest attention.

2. The effect of this attraction being different in different ships, and not progressive always, but often irregular, no general calculation will therefore apply in the case of all ships, to ascertain it for the purpose of correction; and, consequently, all the rules hitherto given for obtaining it, particularly in arctic climates, cannot be relied on..

3. As six compasses were compared with each other on board the *Isabella*, and found to agree in the *same* place, and all to disagree, when placed in different situations between the stern and foremast, it is evident that the aberration in any ship will vary, according to the station of the compass at the time of using it; and, therefore, as the point of change will not be the same at every part of the ship, all observations must be made in one and the same place, where the point of change has been obtained, and to which only that point of change will apply.

4. The aberration does not always continue the same under the same apparent circumstances, and varies according to the point the ship's head is on.

5. The aberration appeared to be materially affected by heat and cold, as well as by atmospheric humidity and density.

6. The direction of the wind seems to have an irregular effect on the aberration.

7. The dip, also, has an irregular effect on the aberration.

8. That the points of change found with the compass, in the same part of the ship, will remain the same, unless some material alteration is made in the stowage of metallic substances on board; yet the *amount* of aberration, with the ship's head on any point of the compass, will be on a proportion, though not a regular one, with the increase or decrease of the variation and dip; by both of which, the aberration appears, in some degree, to be governed, though not the points of its change, they seeming to be independent of any influence but the ship's attraction or magnetism; and which is not of *equal* force in every part of the same ship, nor, perhaps, alike in any two. It is, however, presumed that, the experiments and observations that have been made, and the rules proposed and exemplified, will be sufficient to correct the errors in the mariner's course, which have so often proved fatal, and hitherto been attributed, perhaps, to defects in compasses, to currents, and other unaccountable causes.

CAPTAIN ROSS'S RULES *for FINDING the POINT of CHANGE in ABERRATION, are as follow :*

RULE 1.—*To find the Point of Change.*

LET the bearing of one distant object, or the transit of two distant objects, (whose *true* bearing from the ship, or from each other, is known,) be taken, with the ship's head at several points of the compass; if they all agree, the ship has no aberration; but, if not, the *one* which is found to *agree* is the point of change.

RULE 2.—*To find the Aberration for the Point steered.*

LET the bearing of the same object be taken with the ship's head on the point of the course steered; and add, or subtract, the differences between them as in increases, or decreases, the variation.

To find the aberration at sea, when a distant object is in view, whose true magnetic bearing is not known :—Let a boat be sent out of the ship's attraction, to take the bearing

ing of the object, and then the bearing of it is to be taken from the ship, in the manner before described. But, even when no distant object is in view, it can be done in fine weather, with smooth water, by veering a boat (copper-fastened) astern with the compass. The ship is then to steer on different courses, (the boat always keeping her masts in one,) until the compasses of the ship and boat agree. If there be no difference between them on any point, the ship has no aberration. But, whatever difference is found between them, on any point, that is the ship's aberration for *that* particular point, and must be added, or subtracted, to correct the ship's course on *that* point, according to the true magnetic course of the boat: and, in like manner, the respective differences, found on the several points, are to be applied to each. On whatever point the courses of the boat and the ship agree, when her masts are in one, *that* is the ship's point of change. The result of observations made with the ship's head on *this* point will give the true variation of the compass; but, if observed on any other points, the error of variation will be according to the amount of aberration, or differences found on those points respectively, between the course of the ship and boat, and must be applied, *more or less*, as the case may require, to correct it. The variation may be observed either before or after this process, for finding the ship's point of change and aberration; and, if amplitudes, or azimuths, are taken at different parts of the ship, the difference between the azimuth compass (wherever it may stand) and the compass the ship steers by, ought always to be taken, and applied in like manner, to obtain the *true* variation.

It would be a great benefit to navigation, if the bearings of remarkable headlands and other objects, on the coasts of different countries, were *correctly* taken, and inserted in published charts: for, a ship, able to approach near enough to take the transit-bearing of any two such objects, whose relative situations were exactly true, could thus know, at once, her *aberration*, on whatever course she was steering, (if the true variation was on the Chart,) since it would be the difference between it and the true transit-bearing laid down on the Chart; taking into consideration, at the same time, the known variation. For instance, supposing a ship to be steering West by compass, along a coast where two remarkable objects are situated, true North or South of each other, and the variation laid down on the Chart is 29° West. On setting these objects in one from the ship, they are found to bear, by compass, N. 24° E., making a difference of 5° for her aberration on the *west* point. So that, if she had now to steer a correct *magnetic* west course, it must be shaped W. 5° S.; or, to make a *true* west course, W. 24° N., according to the variation of 29° West.

If, again, with her head N. by E., she finds the transit-bearing of the two objects to be N. 29° E. by compass, agreeing with that laid down on the Chart; according to the variation, then, *that* is the point of change, because there is no *aberration*.

Again, if, in steering E. by compass, she finds the transit-bearing of the two objects to be N. 34° E. by compass, the difference between it and that on the Chart, according to the variation, being 5° ; therefore, to shape a correct magnetic East course, she must steer E. 5° S.; or, to make a true East course, E. 34° S.

Men of war, and, indeed, all ships, should, at every opportunity, try the aberration, and ascertain their points of change; and, after it is found, the metallic matter ought not, in any quantity, to be removed.

Our object in giving the preceding Remarks and Extracts, is rather to promote than to satisfy enquiry. Those who wish to understand the subject more fully will, of course, consult the various publications upon it which have recently appeared; more particularly the volume by Mr. Bain, already noticed, and a subsequent work, by Peter Barlow, Esq. F.R.S. &c. entitled, "An Essay on Magnetic Attractions, particularly as respects the deviation on shipboard, &c., with an easy practical method of observing the same in all parts of the world." *Second edition*. London, 1824. The latter is strictly scientific, and describes a variety of interesting experiments, made under the sanction of Government, at Woolwich. Among the more important results of these experiments is this, that "*the power of attraction in iron resides wholly on the surface, and is independent of the mass*: the conclusion drawn from this fact appears, however, to be that, the magnetic fluid requires a certain thickness of metal, exceeding one-thirtieth of an inch, in order effectually to develop itself, and to act with its maximum of effect;—a striking instance of the intimate analogy which subsists between the magnetic and electric fluids."

fluids.*" Mr. Barlow adds, "the analogy, however, after all, may be rather apparent than real: as it is not improbable that every particle of iron possesses the same power, but that that appertaining to the particles in the interior of the mass is intercepted by those particles which lie nearer to the surface."

Mr. Barlow, in a note, has said, "I cannot resist adding a note in this place, which may be thought of some importance. Upon my examining the compasses in store in Woolwich Dock-Yard, I could scarcely bring myself to believe that the instruments exhibited to me were those actually employed in his Majesty's vessels: the cards, bowls, needles, &c. seem all worthy of each other, equally clumsy and imperfect. It is true, I had been using the most delicate needles, and might view those shown me in the worst light; but still that they are, generally speaking, wretchedly defective, I found to be the prevailing opinion of every one who knew any thing of the business: and it does appear to me very unaccountable that vessels of such immense value, and the safety of so many valuable lives, should be endangered by the employment of instruments that would have disgraced the arts as they stood at the beginning of the eighteenth century."†

In one of the letters of our friend Captain Livingston, we find the following remarks:—

"It is strange with what pertinacity many maintain that iron will not attract the needle of a compass, provided the iron is covered with wood or puttied up. For my part, I am well convinced that many a fine ship has owed her loss to iron near the compass. It seems hardly credible, but it is nevertheless true, that I have seen more than one vessel with *copper-nailed* decks, and an *iron-fastened* binnacle!

"I have seen iron attract the compass-needle through a piece of plate-glass, and through two ships' slates."—A. L.

"M. Poisson, in a Memoir on the Theory of Magnetism, Paris, 1824, has shown that, if a magnetic needle be placed in the *interior of a hollow sphere of soft iron*, and so small as not to exert any sensible influence on the sphere, it will not be subject to any magnetic action, and will consequently *not exhibit any polarity* from the effect of the earth's magnetism, or from that of any other magnets placed without the hollow sphere."—*Journal of Science*, &c., No. XXXIV.

Mr. Walker has noticed that, unarmed vessels have a very great advantage over ships of war, &c. in being able to steer more correctly, because they are under no necessity whatever of having any iron near to their compasses. However, he adds, their binnacles ought to be so constructed, that their compasses may be at least two feet from the deck, which would prevent the nails from affecting the needle.

"But, on board ships of war, and all armed vessels, where there are great quantities of iron, it is hardly possible to account for all the different derangements of the magnetic polarity; for it will be as variable as the different positions that a ship may be in, and in every part of the ship the compass will have a different variation from the true meridian."—*Walker's Appendix*, 195.

"In his Essay, above mentioned, Mr. Barlow has developed another source of unsuspected error, which he found in a land-compass, excellently constructed. The needle was 6 inches in length, of the bar form, and very powerful. It had remained, for a time, in a certain position; and, on trial, it was found that a part of the brass box itself had become sufficiently magnetic to produce a vibration of the needle, when applied

* Another important result is, that, in a certain plane, an iron ball seems to have no influence on the needle; and that this plane is exactly, or very nearly, perpendicular to the direction of the dipping-needle.

† See the opinion of Captain Flinders, on the same subject, page 276. Of these compasses we have been told, the needles have, for some years past, been pressed, or stamped, out of common sheet-steel, at Sheffield; in order that his Majesty's ships may be supplied at a *cheap rate*. It is astonishing that needles of the common form and quality are not altogether exploded; and that others, superior in every respect, are not in general use. See, upon this subject, Mr. Walker's Treatise on Magnetism, pages 50 to 53, and Mr. Downie's Remarks, prefixed to his Sailing Directions for the Eastern Coast of Scotland. The *improper form* of the needle alone, independent of local attraction, may produce an error in a ship's course, amounting to 5 or 6 degrees.—EDIT.

outside the glass, of 14 or 15 degrees, and to retain the same $1\frac{1}{2}$ degree out of its natural direction. Every screw and detached piece in the instrument had acquired the same quality in some, though a less, degree, so that no dependence could be placed upon the needle, until they were all removed."—*Essay*, pp. 16, 17.

"In 1820, Mr. Bywater wrote and published, at Liverpool, a Tract entitled, '*Observations on the Deviation of the Compass, with Illustrative Remarks on its Magnetic Principles.*' In this little work, the ingenious writer has clearly shown, from experiment, the effect of iron knees on the compass: and he proposes to relieve it from that influence by elevating it on a temporary ladder or stage, about 20 feet high, erected just before the mizen-mast. "To take," he says, "advantage of this arrangement, a person should go up to inspect this compass every time the ship goes about, or whenever there is any suspicion that the ship's compasses are influenced by the iron on board; and, from his report and comparison with the ship's compasses, such remarks should be entered in the log-book, as will enable the sailing-master to make those allowances in the day's work as shall exactly counteract this local attraction." Testimonials of the utility of this mode of obtaining the true variation are added; the first of these, by Mr. J. Williams, commander of the merchant-ship *Albion*, states that, on a voyage to and from New York, he found, by placing a compass about nine feet abaft the binnacle, and seven feet above the deck, that it was uninfluenced by the iron knees, &c. on board. Sometimes, according to the course of steering, it differed from the binnacle compass full one point, while at other times they agreed. Similar results were found by Mr. Neverson, another mercantile commander, on a voyage to and from the Island of St. Vincent. This simple mode of ascertaining the aberration of the needle on board, when other means are wanting, is, therefore, worthy of attention.

"Mr. Bywater has noticed the experiments on the magnetic properties of brass, formerly made by Mr. Cavallo; from which it appears, that most brass becomes magnetic by hammering, but loses that quality by annealing or softening in fire.

MR. BARLOW'S CORRECTING PLATES FOR THE COMPASS.

"Since the action of any mass of iron, or system of iron bodies, may be referred to two points, indefinitely near to each other, in the general centre of attraction of such mass or system, it follows that, in a ship, all the action may be referred to a fixed point in the vessel, and that the line joining that point and the pivot of the needle will be fixed in position, as regards the ship, in all parts of the world; and, secondly, since the whole magnetic power of iron resides on its surface, it is easy to procure a plate of iron, of inconsiderable weight, that shall have, when placed near the compass, an effect upon the needle equal to the great mass of iron in the vessel situated at a greater distance; and, if, also, the centre of attraction of this plate be fixed in the line above mentioned, then, in whatever direction the vessel is placed, or in whatever part of the world the observation may be made, the plate will always produce a disturbance on the needle equal to that of the ship; so that, by obtaining the one by observation, the other, that is the disturbance produced by the ship, becomes known. Hence, whatever may be the law by which this disturbing power is governed, or whatever may be the dip of the needle or the direction of the ship's head, the plate and the iron of the vessel attract the needle the same, both in quantity and direction, and the one becomes known by the observation made on the effect of the other.

"Upon this principle, a circular plate of iron,* for counteracting the effect of aberration, has been contrived by Mr. Barlow. The proper situation for this plate, or neutralizing force, is to be found by experiment; and, in order to attain this situation, a place must first be selected for the azimuth or regulating compass to be fixed in, for observation, during the period of the ship's being in commission. It will then be necessary to ascertain the local attraction of the vessel, which may be done in the following manner:

"The ship being moored, or lying with a short scope of cable, must have anchors so arranged as to admit of her head being directed to each point of the compass succes-

* Or several parallel plates, screwed together.

sively, and there steadied, whilst the bearing of a remote object is taken, (the more distant the better,) to avoid the parallax, which would otherwise affect the observations. It will then be found that the bearings, thus observed, differ from each other according to the attractive power of the vessel, from 6 or 8 to 26 or 28 degrees; a difference which is caused by the iron of the ship attracting the needle out of its proper direction, to the eastward with the ship's head to the East, and to the westward with the head to the West.

"On examining these several bearings, there will be found *two*, at opposite points of the compass, that will nearly agree with each other, the mean of which must be accounted the correct magnetic bearing of the object; and these points will also indicate the line of non-attraction in the vessel, and which will generally be found nearly fore and aft: in this line the plate is ultimately to be fixed.

"By comparing the correct magnetic bearing, as before found, with the observed bearing at the several points, the amount of the local attraction, at each point, will be ascertained.

"It now remains to determine the position of the plate in which it will correct the deviations. This will now be readily done by means of a small table, which Mr. Barlow intends to supply with every plate for that purpose. In this table will be found a variety of local attractions, comprehending all possible limits for every class of vessels, and in which will be found those of the vessel in question, corresponding to which will be found two numbers, one being the distance of the centre of the plate below the pivot of the needle; and the other its distance from the plumb-line passing through the same: at this depth and distance, in the line of non-attraction already mentioned, the plate must be fixed abaft the compass, in which position it will be found to correct those deviations caused by the great mass of iron lying before the compass; so that if the vessel be again swung, no discrepancies will be found in the bearing of any object in this or any other part of the world."

The importance of this principle of correction has been amply demonstrated in several voyages. It is one of those valuable discoveries which have originated, not in mere chance, but from rigorous and scientific investigation; and it has been appreciated accordingly. The Board of Longitude has expressed its opinion by conferring on Mr. Barlow the largest premium (£500) allowed by the late longitude act; at the same time stating that this sum is not to be considered as any remuneration for the time and expenses bestowed upon the enquiry, which is recommended to be considered by the Navy and Admiralty Boards, as distinct from the above reward. The Honorable Board of Trinity-House has complimented the Professor with £200, and the East-India Board with a similar sum. Latterly, it has been announced that Commodore Krusenstern has written to Professor Barlow a very satisfactory and complimentary letter on the result of experiments with the Plate, made in a ship of the Imperial Navy at Cronstadt; and the Russian government, in consequence, has given orders for all its ships to be furnished with correcting compass-plates, similar to those fitted in the British ships. A valuable gold watch and rich dress chain has been presented to Mr. Barlow from the Emperor Alexander, as a mark of the Imperial approbation, and a deserved acknowledgment of his merit, &c.*

MR. POPE'S IMPROVED MARINER'S COMPASS.

This compass is the invention of Mr. William Pope, of Ball-alley, Lombard-street, London, and its peculiarity consists in its suspending the needle in such a manner as to combine the advantages of the dipping-needle with those of the ordinary compass: the needle, from the mode in which it is suspended, being perfectly at liberty to *dip* in all latitudes, while the card retains its *horizontal position*.

Again, this compass increases its power of magnetic force where in others it diminishes, and that in every latitude from the equator to the poles; secondly, it retains its

* The Plate, with Instructions for its use, is at present sold by Messrs. W. and T. Gilbert, in London; and we presume that it will soon be obtainable at all the principal sea-ports.

force even situated nearly over the polar point, where all others entirely lose it and become useless; thirdly, it is more steady on its point, a circumstance of the first importance when the agitation is increased by the motion of the vessel.

A complete description of the compass, with testimonials in its favour, by Dr. Birkbeck, and other scientific gentlemen, is given in No. 29, of the, *'London Mechanic's Register'*, 7th May, 1825.

VIII.—ON THE GENERAL TEMPERATURE OF THE SEA; MARINE THERMOMETER; A THERMOMETRICAL JOURNAL; TABLES OF CURRENTS, &c.

CAPTAIN HORSBURGH has said, "the temperature of the sea is a phenomenon of nature hitherto but little investigated, although it appears to be closely united with the improvement of nautical science: the following observations may, therefore, be not altogether unimportant to navigators.

"It has been thought that, the temperature of the ocean was subject to little mutability, particularly between the tropics; but the temperature of the surface of the ocean is affected by changes of the superincumbent atmosphere, as well as by other local or adventitious causes.

"1st, When the atmosphere is cold, a portion of its temperature is imparted to the surface of the ocean, by which the temperature of the latter is diminished; and, in calm settled weather, the maximum of temperature of the sea has been experienced about, on, or two hours after, mid-day, and the minimum about sun-rise in the morning.*

"2d, Tempestuous weather raises the temperature of the sea, which is probably produced from the agitation or friction of the broken waves, by the particles of water rubbing against each other.

"3d, *Currents have a more powerful influence than any other cause, in changing the temperature of the surface of the ocean*; so that, in either hemisphere, a current proceeding from the cold polar regions toward the equator, diminishes the temperature of the sea; whereas a current running from the inter-tropical regions, toward either pole, raises its temperature."

How long the great body of a current preserves its original temperature, has been shown already in the description of the Gulf-Stream, and will be more clearly shown in a subsequent part of this section.

"4th and lastly, The depth of the sea appears also to have a great influence on the temperature of its surface; for the immense body of water contained in the ocean preserves its heat; whereas, in places of little depth, the surface of the water is cooled by the increased evaporation. The temperature of the ocean, therefore, ought to be higher than that of seas which have little depth of water, in the same parallels of latitude. This seems to be verified by the experiments and observations of Dr. Davy, during his voyage to Ceylon; as, in approaching the land of Table Bay, at the Cape of Good Hope, the temperature of the sea decreased 2° ; and it also decreased 2° , when the island of Ceylon was closely approached, although the bank of soundings does not extend far out from either of these places. Were the temperature of the sea, as well as that of the atmosphere, conjointly registered in the journals of navigators, several times during twenty-four hours, it would greatly assist the improvement of nautical science; and the proximity of land, or shoal-banks, might probably be ascertained, by carefully observing the temperature of the sea."†

* By the experiments and observations of Dr. John Davy, during a voyage to Ceylon.

† It has also been found that the temperature of the water changes 2° on the edge of the bank of Channel Soundings, in the parallel of $50^{\circ} 30' N.$; that is, from about 47° to 45° .—Ed.

These remarks, by Captain Horsburgh, corroborate those already given in pages 115 to 126 of the preceding part of the present volume.

With respect to the temperature of the sea, at different depths, it seems reasonable enough to suppose that, in summer-time, it will be hotter at the surface than at any considerable depth below it, and that, in winter, it will be colder: this has been confirmed by many experiments.

Mr. Wales, who accompanied Captain Cook, has given the temperature of the sea as found in different depths and places. His apparatus, for trying the same, consisted of a square wooden tube, of about eighteen inches long, and three inches square externally. It was fitted with a valve at the bottom, and another at the top, "and had a contrivance for suspending the thermometer exactly in the middle of it. When it was used, it was fastened to the deep-sea-line just above the lead, so that all the way it descended, the water had a free passage through it, by means of the valves, which were then both open: but the instant it began to be drawn up, both the valves closed by the pressure of the water, and, of course, the thermometer was brought up, in a body of water of the same temperature, with that it was let down to." With this instrument, which is much the same with one formerly described by Mr. Boyle, in his observations on the saltness of the sea, water was fetched up from different depths, and its temperature accurately noticed in different seasons and latitudes. In the Ethiopic Ocean, Sept. 27th, 1772, in latitude $24^{\circ} 40'$ South, the heat of the air was $72\frac{3}{4}^{\circ}$, of the water of the surface 70° ; but at the depth of 80 fathoms, it was 68° . Also, on December 27, 1772, in lat. $58^{\circ} 24'$ South, long. $27\frac{1}{2}$ East, the heat of the air was 31° , of the water, at the surface, 32° ; but, at the depth of 160 fathoms, $33\frac{1}{2}^{\circ}$.

In the voyage to Spitzbergen, 1773, Captain Phipps made use of a bottle to bring up water from the bottom, which is thus described: "The bottle had a coating of wool three inches thick, which was wrapped up in oil-skin, and let into a leather-purse, and the whole inclosed in a well-pitched canvas bag, firmly tied to the mouth of the bottle, so that not a drop of water could penetrate to its surface. A bit of lead, shaped like a cone, with its base downwards, and a cord fixed to its small end, was put in the bottle, and a piece of valve leather, with half a dozen slips of thin bladder, were strung on the cord, which, when pulled, effectually corked the bottle on the inside. We here describe two of the experiments which were made during that voyage.

"August 4th, 1773, in latitude $80^{\circ} 30'$ North, the heat of the air was 32° , of the water at the surface 36° , of water fetched up from the depth of 60 fathoms under the ice, 39° . September 4th, 1773, in latitude 65° North, the heat of the air was $66\frac{1}{2}^{\circ}$, of the water at the surface 55° , of water from the depth of 683 fathoms 40° . It therefore appears, from all these experiments, that, when the atmosphere was hotter than the surface of the sea, the superficial water was hotter than at a great depth; and, when the atmosphere was colder than the surface of the sea, it is evident that the superficial water was somewhat colder than at a considerable distance below it."

On the temperature of the sea, as found on the late expeditions to the North, the following remarks have been made. "A series of observations, on the temperature of the sea, at the surface and at certain depths, may serve to correct erroneous notions, which, it would appear, have prevailed on this subject. We have no doubt that they are the most accurate that have yet been made, and in deeper water than a self-registering thermometer had ever been sent down before in any part of the world. The result is very different from that of former observations. It seems that, in Baffin's Bay, the temperature, generally speaking, decreases with the depth. At 1005 fathoms, in lat. $71^{\circ} 24'$, the temperature was $8\frac{1}{2}^{\circ}$, at the surface, 36° ; and, whenever the depth exceeded 100 fathoms, the thermometer generally descended to 30° , or below, when 34 or 35 at the surface. Near Cape Wilsingham, it is stated that, from the depth of 660 fathoms, the thermometer came up at $25\frac{1}{2}^{\circ}$; from 400, at 28° ; from 200, at 29° ; and from 100, at 30° ; the temperature of the air being 37° . It would be difficult to explain why the sea remained in the state of water at $25\frac{1}{2}^{\circ}$ of Fahrenheit. Did the pressure of the column of water prevent its freezing? or was the water more strongly impregnated with salt? These and other observations, made in the course of this voyage, both on land and sea, are completely at variance with the theory of isothermal lines of temperature, which had been assumed, as it would now appear, from a too-limited number of facts. But the most unaccountable circumstance is that of the Polar expedition having,

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in the seas of Spitzbergen, on the same parallels of latitude, invariably obtained a contrary result, the temperature of the sea increasing with the depth; so that, when the thermometer, at the surface, stood at 32° or 33° , at 500 fathoms it was 36° or 37° . We pretend not to explain this singular anomaly; indeed, we do not conceive that we are yet in possession of a sufficient number of facts to enable us to reason on the subject.”—(*Quart. Rev.* No. XLI. May, 1819.)

The following experiments will prove that, between the tropics, and in the temperate zones, at sea, “when the temperature of the atmosphere exceeds that of the surface of the sea, the superficial water is *generally* warmer than at certain depths beneath it; (we say generally, because, in soundings and confined waters, local causes effect many exceptions to this general rule;) and, in all probability, the greater the depth, the colder the fluid in that case.

“On the 23d of February, 1804, off Falkland’s Islands, in lat. 52° S., and about the longitude of 50° W., Commodore Krusenstern says, the temperature of the air was 59° , of the surface 55° ; and at the depth of 55 fathoms, 52° ; the whole depth at the time being 75 fathoms. On the 9th of March, 1804, beyond Cape Horn, in lat. $50^{\circ} 20'$ S., and long. $72^{\circ} 45'$ W., the temperature of the air was 41° ; the surface of the sea 39° ; at the depth of 60 fathoms 38° ; and at 100 fathoms 36° . On the 24th of May, in the Pacific Ocean, 56 miles south of the equator, and in long. $146^{\circ} 16'$ W., the temperature of the air, and the surface of the sea, were equal, at 83° ; but that at the depth of 100 fathoms was 61° . On the 22d of June, in a perfect calm, on the tropic of Cancer, in the Pacific, the temperature of the surface of the sea was 78° ; at the depth of 25 fathoms, $76\frac{1}{2}^{\circ}$; at 50 fathoms, 71° ; and at 125 fathoms, 62° ; so that there was here a *progressive difference* of temperature of $2\frac{1}{2}^{\circ}$ at 25 fathoms, 7° at 50 fathoms, and 16° at 125 fathoms.* Many more examples might be given to the same effect, if it were necessary. A very remarkable one is mentioned by Mr. Abel Clarke, in his recent work: he informs us that, “Captain Wauchope, of his Majesty’s ship *Eurydice*, when within a few leagues of the equator, during a calm, put his apparatus overboard, and allowed it to descend till it had run about 1400 fathoms of line; but he estimated the perpendicular depth at 1000 fathoms. The temperature of the surface was 73° of Fahrenheit. On drawing up the instrument, he found the thermometer marking 42° ; a difference of temperature of 31° .” And there can be little doubt but that the difference of temperature was progressive, from the surface down to that depth.

It has already been observed, “that, in shallow seas, the cold substratum of liquid is brought nearer to the surface;” but though, as a general axiom, this may be true, yet it may not be relied on in particular cases. Some instances, in proof, may be collected from the journal of Captain Basil Hall, of the *Lyra*, from the Yellow Sea, 1816, who made some experiments on the temperature of the sea at the surface, at the Loochoo Islands, and in the Yellow Sea, &c.

On the 19th of July, when off Chusan,† in 32 fathoms water, the temperature of the surface of the sea was 78° and 80° ; and on the 22d, in 43 fathoms, it was only 77° and 72° ; but, when at anchor in $3\frac{1}{2}$ fathoms, in the Gulf of Pechelee, in lat. $38^{\circ} 49'$, and long. $117^{\circ} 49'$ E., on the 27th of July, the temperature of the surface was as high as 82° . Also on the 3d of August, when at anchor off Pei-ho, the temperature of the surface was 82° at noon, and 80° at midnight, and *there* it was generally warmer than the atmosphere itself. When at anchor in Napakiang Harbour, the general temperature of the surface of the sea was about 83° ; but out at sea, off the Island Loochoo, when in lat. $26^{\circ} 56'$, and long. $127^{\circ} 56'$ E., the surface was 4 or 5 degrees colder; being, on the 14th and 15th, only $79\frac{1}{2}^{\circ}$ and 78° . Again, on the 20th of October, at anchor in Napakiang, when the autumnal cold had lowered the temperature of the sea’s surface *there* to $75\frac{1}{2}^{\circ}$ and 75° , (or 7 and 8 degrees below what it was when anchored there before,) yet, in the Sea of Japan, the surface was also lower, being 74° and 73° .

Thus, in these particular instances, the water became *warmer* (at least at the surface) the nearer the land was approached; and also as the depth of water decreased.

* M. Krusenstern has given the temperature in the degrees of the scale of Reaumur; but we have reduced them to those of Fahrenheit, for the convenience of comparison, &c.—Ed.

† In latitude $30^{\circ} 30'$ North; longitude about $124\frac{1}{2}$ East.

It will presently be seen, from the journal of Captain Livingston, that, *under similar local circumstances*, the water of the Gulf of Mexico, like that of the Yellow Sea, increases in heat towards its principal river. The one towards the Missisipi, the other towards the Pei-ho. In the Mexican Gulf the heat of the sea was the greatest known; being at the temperature of 90° on the 30th of August, 1818; while that of the Yellow Sea was 82° on the 27th of July, 1816. The general principle, as to the Atlantic Ocean, is, however, incontrovertible.

Mr. Clarke has also published the result of a few experiments made by him on the temperature of the sea, in soundings both at the surface and bottom, which are highly useful and satisfactory. They are shown in the following Table.

No.	Date. July 1816.	North Latitude.	East Longitude.	Depth in Fathoms.	Place.	Temperature.			Difference of Temperature.		
						Air.	Surface.	Bottom.	Of the air and surface.	Of the surface and bottom.	Of the air and bottom.
1	23 8 A.M.	$35^{\circ} 01'$	$123^{\circ} 40'$	40	Open Sea.	76	74	65	2	9	11
2	24 noon.	$36^{\circ} 24'$	$122^{\circ} 59'$	15	do.	75	71	67	4	4	8
3	25 8 A.M.	$37^{\circ} 30'$	$122^{\circ} 40'$	20	do.	62	67	62	5	5	10
4	8 P.M.	.....	.....	15	do.	74	69	66	7	3	8
5	26 6 A.M.	$37^{\circ} 58'$	$121^{\circ} 34'$	15	Among the Meetau Islands.	74	67	66	7	1	8
6	27 11 P.M.	$38^{\circ} 12'$	$120^{\circ} 30'$	15	Gulf of Pechelée	75	74	72	1	2	3

From these experiments, (Mr. Clarke observes,) it appears, first, that the sea "diminishes in its temperature in proportion to its depth;" and second, "that the difference of the temperature of the surface, and any given depth, within a certain range, is *greater* at sea than near the land;" and third, "that the difference of the temperature at the surface and bottom is *greatest*, when that of the air and surface is least."

The 1st and 3d positions appear evident on the face of the *experiments*; but the experiment No. 3, seems to affect the correctness of the 2d position, for the difference of the surface, and 20 fathoms depth, was 5° ; and by that of the first experiment, made *farther* from the land, there was a difference of 9° *only* in 40 fathoms, which was proportionally less than *near* the land.

It is remarkable, however, that all these experiments (except the 3d) prove, as far as they go, that, in the depth of 15 fathoms, the water at the bottom was invariably *warmer* than it was found to be at the depth of 40 fathoms in the open sea; and in the Gulf of Pechelée, where the 6th experiment was made, it was no less than 7° *warmer* at the depth of 15 fathoms.

The lower state of the atmosphere, when the third experiment was made, would seem to account for the temperature of the water at the bottom being so much below what it was found to be by the others.

There is also a much larger proportional difference of the temperature of the air and water, at the depth of 20 fathoms, than there was by the rest of the experiments.

These experiments also prove that, "in these shallow seas, however, the cold substratum of liquid *was not* brought *nearer* the surface," at this season of the year. So that, in these instances, there was "no increasing coldness of water drawn up from the depth of only a few fathoms, to indicate to the navigator, who traverses the wide ocean, his approach to land or banks; but the very reverse."—*Naval Chronicle*, Oct. 1818. Google

M. de Humboldt has given the following statement, from numerous experiments which he made between the 9th of June and 15th July, 1799, on the surface of the Atlantic.

Latitude.	Longitude from Greenwich.	Temp. of Water.
39° 10' N.	13° 58' W.	59°
34 30	14 35	61
32 16	14 44	63
30 36	14 34	65
29 18	14 20	66½
26 51	16 53	68
20 8	26 31	70
17 57	30 54	72
14 57	42 20	74
13 51	47 23	76½
10 46	58 34	78

From Corunna to the Mouth of the Tagus, the water of the sea varied but little in its temperature; but, from the 39th degree of latitude to the 10th, the increment was very sensible and very constant, though not always uniform. From the parallel of Cape Mondego to that of the Salvages, the progress of the thermometer was almost as rapid as from 20° 8' N. to 10° 46'; but it slackened extremely on the limits of the torrid zone, from 29° 18' to 20° 8'. This inequality is, no doubt, caused by the currents, which set on

one side of the ocean to the S.E., and on the other to the N. W. Don Cosmo de Churruca, who crossed the equator in October, 1788, in the 23d degree of western longitude, found the greatest temperature of the water to be in the latitude of six degrees north.* In these parts, in latitudes equally distant from the equator, the water of the sea was colder to the south than the north.

From the equator to the 25th and 28th degrees of north latitude, the temperature is remarkably constant, notwithstanding the difference of meridians. It is more variable in the high latitudes, where the melting of the polar ice, and currents caused thereby, diminish the heat of the ocean. The following table, which contains experiments taken without discrimination from several nautical journals, confirms these assertions.

TABLE OF THE TEMPERATURE OF THE ATLANTIC OCEAN.

Latitude.	Longitude.	Temperature.	Time.	Observers.	Mean Temperature.
0° 58' S.	25° 14' W.	81°	Nov. .. 1788	Churruca.	80½° (Cook.)
0 57 —	27 51 —	82	April .. 1803	Quevedo.	
0 33 —	19 0 —	82	March. 1800	Perrins.	
0 11 N.	81 55 —	82½	Febr. .. 1803	Humboldt.	
0 13 —	49 22 —	81	May.... 1800	Perrins.	
25 15 —	18 16 —	68	June... 1799	Humboldt.	69¼° (La Perouse and Dalrymple.)
25 29 —	37 34 —	70	April... 1803	Quevedo.	
25 40 —	24 0 —	69	March... 1800	Perrins.	
27 40 —	14 44 —	70	Jan.... 1768	Chappe.	
28 47 —	15 57 —	78	Oct.... 1788	Churruca.	54° (Cook and D'Entrecasteaux.)
42 34 —	13 25 —	52	Febr.... 1800	Perrins.	
43 17 —	29 7 —	60	May.... 1803	Quevedo.	
43 58 —	10 47 —	60½	June... 1799	Humboldt.	
44 58 —	32 27 —	54	Dec.... 1789	Williams.	
45 13 —	2 20 —	60	Nov.... 1776	Franklin.	
48 11 —	11 58 —	57½	June.... 1790	Williams.	

M. de Humboldt adds, "It is very remarkable that, notwithstanding the immensity of the ocean, and the rapidity of currents, there is a great uniformity every where in the greatest heat of the equinoctial seas. Don Cosmo de Churruca found it, in the Atlantic Ocean, at 83°; Mr. Perrins, in 1804, at nearly the same; Mr. Rodman, in a voyage from Philadelphia to Batavia, 83¼°; and M. Quevedo, 83½°. We must recollect that

* This, it may be observed, accords with the termination of the S.E. trade-winds to the northward of the equator; (see Table, page 58;) and there is no doubt that it is equally variable. Little argument is required to prove that the two fluids, air and water, and their modifications, winds and currents, are affected by similar impulses. A certain parallel to the north of the line may be considered as the equator of temperature between the ices of the northern and southern polar regions. — Ed.

under the temperate zone, to the north of the parallel of 45° , the mean temperature of different years vary more than four degrees.

“ The greatest heat of the seas, which is from 82 to 84 degrees, proves more than any other consideration that the ocean is, in general, warmer than the atmosphere with which it is in immediate contact; and of which the mean temperature, near the equator, is from 68 to $80\frac{1}{2}$ degrees.—See, farther, *Humboldt's Personal Narrative*, Engl. Tr. Vol. II. p. 68.*

TEMPERATURE of the GULF-STREAM, and of the OCEAN thence towards GIBRALTAR, from the Journal of *Captain Andr. Livingston*, June, July, Sept. and Oct. 1818.

Captain Livingston, in his passage from Havanna to the Missisipi, June 28 to July 1, 1818, in the ship *Asia*, passed over the edge of the Tortugas Bank on the 28th, and appears to have been much retarded by the current. Variation, this day, by amplitude, $6^{\circ} 33' E.$; ship's head N.W. by W. At noon, lat. obs. $24^{\circ} 40'$, long. by obs. and acc. $83^{\circ} 52'$. Next day, at noon, the ship was in lat. $26^{\circ} 36'$, long. $85^{\circ} 23'$; and, on the 30th, at noon, in lat. $28^{\circ} 19'$, long. $87^{\circ} 5'$. On this day a bottle was thrown overboard, with a view to elucidate the effect of the waters of the Missisipi, including a note, requesting that an account of it, when found, might be transmitted to the Editor of this work, but which has not since been heard of. At 10 a.m. July 1, the ship had passed the Bar. The prevalent winds, during the passage, were mostly E.N.E., and N.E. by E. to N.E.

The *Asia* quitted the Missisipi on the 30th Aug. 1818; at 5 p.m. the thermometer stood at 90° in the water, when the Bar bore N. 62° W. 28 miles distant. At New Orleans it generally stood at 87° , $87\frac{1}{2}^{\circ}$, and sometimes 88° , in the water; and, in the air, shaded, during the month of August, it ranged from 85° to 96° .

The route of the ship to Gibraltar, from the 30th of August to the 22d of October, is indicated by the statement in the Table annexed, which exhibits the ship's place, either by account or observation, every day at noon, with the temperature of the air in the afternoon, midnight, and noon, of every twenty-four hours, and the corresponding temperature of the water: the contents of the latter columns have been selected from a much greater number of observations, in order to form a lucid statement, at one view. The * in the first column indicates a note following the Table; † signifies latitude observed; ○ longitude by lunar distances, &c.

Captain Livingston says, “ The thermometers used for the temperature were carefully tried, proven to be excellent, and to correspond accurately with each other. These instruments, both for the air and water, had metal scales; as I found that those with wooden and ivory scales by no means so susceptible of temperature as those with metal. I also found that thermometers, inclosed within a wooden frame, with a glass-front, even when they had a metal scale, were not so susceptible as those which had the tubes themselves exposed. I found, also, at first, by experiments at New Orleans, that the mercury dropped so quickly, after being withdrawn from the water, that there was hardly time to read it off: to remedy this, I had a tin-case made, loaded with lead, by which I was enabled to have the thermometers sunk deeper in the water; and, by keeping nearly one half of the instrument immersed in the water, while reading off, I obtained sufficient time for that purpose before the mercury began to fall.

“ An oven-like heat was constant at New Orleans during my stay there, day and night; the thermometer was never below 85° when placed in the draught of our cabin-windows; where, I remarked that, it was always as low as it was in the houses on shore; which may be readily credited when the effect of the deck-awnings is considered.”

A. L.

* In 1823, Captain Sabine found the temperature of the water, at a depth of 6000 feet, in latitude $20\frac{1}{2}^{\circ}$ N. and long. $83\frac{1}{2}^{\circ}$ W., near the junction of the Caribbean and Mexican seas, to be $45^{\circ} 5'$, that of the surface being 83° . He infers that, 100 or 200 fathoms more line, would have caused the thermometer to descend into water at its maximum of density, as depends on heat; this inference being on the presumption that the greatest density of salt-water occurs, as is the case in fresh-water, at several degrees above its freezing point.

Astronomic Time.	Ship's Place at Noon.		Temperature of the Air.			Temperature of the Water.			Remarks.	
1818.	Latitude.	Longitude.	P.M.	Mdnt.	Nn.	P.M.	Mdnt.	Nn.		
Aug. 31	27 45N.↑	88 27 W.	86	84	89	86	86	86	In the Gulf of Mexico.	
Sept. 1	27 28 ↑	87 12	89	86	89	87	86	87		
2*	26 55 ↑	86 15	88	86	85	87½	87	88		
3	26 22 ↑	85 45	87	87½	88½	88	86	86		
4	25 51 ↑	85 22 ○ (	89	87	89	86	86	86		
5	25 17 ↑	85 6 ○ (	86	86	88	86	86	86		
6*	25 19 ↑	85 20 ○ (	86	85½	87	86	86	86		
7*	24 32 ↑	83 38	85	85	86	86	86	86		
8*	23 27 ↑	82 28 ○ (	86	86	87	86	86	86		
9	24 11 ↑	80 41	87	86	86	86	86	86	In the Strait of Florida.	
10*	25 48 ↑	79 30	87	86	83	86	86	85		
11*	27 30 ↑	79 35	82	84	85	85½	85	85		
12*	28 43 ↑	79 23	85	82	85	84½	84	85	Between the parallels of Cape Canaveral and CapeHatteras.	
13	29 48 ↑	79 37	84	80	85½	84½	85	82½		
14	31 31 ↑	80 3	84	81	87	84	84	83		
15	32 52 ↑	78 15	84	80½	85	84	84	82½		
16*	33 44 ↑	78 3	85	78	83½	82	81	84		
17	35 52 ↑	73 4	85	80½	84	84	83	82½		
18	36 25 ↑	69 45	84½	80	81	82½	83	80		
19	36 37 ↑	67 39	81½	75½	78	77½	77	77½		
20*	37 39 ↑	65 8	80	78	80	77	77	80		On the Passage between Cape Hatteras and the Azores, or Western Islands.
21	38 56 ↑	62 20	77	74	82	82½	81	77		
22*	38 56 ↑	60 7 ○ (	78	74	82	78	77	78		
23	39 4 ↑	58 16 ○ (	84½	70	78	78	77	79		
24*	39 20 ↑	55 9 ○ (	77	72	77	79	76	77		
25*	39 24 ↑	51 16	75	68	73	79	76	76		
26	39 37 ↑	47 33 ○ (	74	72	80	77	76	77		
27	40 8 ↑	43 30	—	—	—	—	—	—		
28*	39 52 ↑	40 18	74	75	72	75	74	74		
29*	39 45 ↑	38 13	77	71	76	74½	74½	75	Azores, or Western Islands.	
30*	39 46 ↑	34 54	76	74	75	74½	74½	73		
Oct. 1*	39 23 ↑	32 13	76	72	78	73	74	74		
2	38 58 ↑	28 54	78	72	76	74	73	73		
3*	38 12 ↑	26 57 D *	72½	70	73	73	70½	71½		
4*	{ Between Pico and St. Michael's. }		75	68	78	71½	71	70½		
5	S. Side of St. Michael's.		76	66	76	71½	70	71		
6*	Ditto.		77	65	66	71	70	70		
7*	Road of Ponta del Gada.		—	—	—	70	70	70		
8	38 4 ↑	26 6	70	—	66	70	70	70	Azores to the Straits' Mouth.	
9	38 6½ ↑	25 41½	79	65	68	70	72	70		
10	38 13½ ↑	25 28	78	64	—	70	71	71		
11*	38 9 ↑	22 45	74	74	70	71	71	70		
12*	38 14 ↑	20 57	68	64	70	74	69	70		
13*	38 16 ↑	17 43	68	68	74	70	70	69		
14	38 2 ↑	13 43	68	68	68	69	69	68		
15	38 5 ↑	10 45 D *	70	64	68	69	68	69		
16*	37 29 ↑	8 26	70	67	64	69	66	66		
17*	36 25 ↑	7 20 Land	64	60	67	66	61	69	Straits' Mouth and Strait of Gibraltar.	
18*	35 48 ↑	7 0 D *	70	65	73	69	69	69		
19*	36 4 ↑	6 20 D *	76	65	73½	69½	69	65½		
20	43 44 ↑	5 49	67	66	64	65½	67	62		
21*	Strait of Gibraltar.		70	62	62	61	62	65½		
22	At → Gibraltar Bay, by the Quarantine Cutter, in 3½ fathoms.									

REMARKS, &c. MADE ON THE PASSAGE.

Sept. 2.—At sun-set, variation of the compass, by amplitude, $6^{\circ} 49'$. (See page 38.) At 7 h., lat. by pole star, $27^{\circ} 21'$.

Sept. 6.—The ship appears to have been in an eddy-current, which set during the first twelve hours of this day with considerable strength towards the N.W., and not in its expected south-easterly direction.

Sept. 7.—The ship had now advanced to the Tortugas' Bank, and the same southerly current, which had so much retarded her on the 23th June, now facilitated her passage.

Sept. 8.—The easterly current does not appear to have assisted so soon as expected: it even seems as if the current, from about 4 p.m. yesterday, to 4 p.m. this day, had rather a westerly tendency.

Sept. 10.—At sun-set, variation, by amplitude, $5^{\circ} 49'$ E.

Sept. 11.—At 8 p.m., supposing the ship to be as close in to the Florida shore as was prudent, wore and tried the thermometer, which had sunk to 82° . In only a quarter of an hour afterwards it rose to 85° . Thus it had indicated an approach to the coast, and demonstrated its utility, even in the Strait of Florida.

Sept. 12.—This day the commander and several of the people fell sick, and continued thus more or less until the 20th, which prevented many more observations for longitude, &c.

Sept. 16.—This day the ship *Globe*, of New-York, passed. She sailed from the Balize four days and a half before the *Asia*, and, as she sails much better, the advance of the *Asia* was attributed to the pertinacity with which she strove, during baffling winds in the Gulf, to gain easting. It appeared by the thermometer this day, that the *Asia* was on the inner edge of the Gulf-Stream for the greater part of the 24 hours; but, when able to run off E.N.E., it became remarkable how the instrument immediately indicated the strong current.

Sept. 20.—P.M. the ship labouring, and making much leeway, shaped a course E.N.E. During these 24 hours fresh breezes from S.S.E., the latter part increasing to a gale, accompanied with small misly rain. The heat of the water, from eight, a.m. seems to indicate that the ship is again under the influence of the Gulf-Stream, or more than in the preceding day, during which there appeared little influence of a current.

Sept. 22.—At sun-set, magnetic variation by amplitude, $12^{\circ} 51'$ W. On the 24th the fluctuations of the mercury seemed to point out either warmer and colder veins of water, or the proximity of some unknown bank. On the 25th, magnetic variation by azimuth, $14^{\circ} 34'$ W.

Sept. 28.—At about 4 p.m. magnetic variation, by azimuth, $22^{\circ} 10'$, ship's head E.S.E., but a heavy sea was running, and the needle unsteady. On the 29th, magnetic variation, by azimuth, $21^{\circ} 32'$ W. On the 30th, a sudden decrease in the temperature of the water caused a sharp look-out for shoals, &c.

Oct. 1.—At about 4 p.m. magnetic variation, by mean of six azimuths, $22^{\circ} 7'$ W. A sudden fall of $1\frac{1}{2}^{\circ}$ in the temperature of the water at 8 p.m., might indicate a vigia, but it quickly rose again.

Oct. 3.—The thermometer, in the sea, fell as we approached Fayal, and continued at $70\frac{1}{2}$, until clear of the strait between Pico and St. George's, when it again began to rise.* On the 4th, at about 5 a.m., the ship was apparently driving with a tide or cur-

* FLORIDA-STREAM, &c.—Captain Ligitt, of the schooner *Maria*, which left Fayal on the 26th of May, 1820, picked up a bottle on the beach of the island of St. George, one of the Azores, which contained a note, dated H. M. ship *Newcastle*, 20th June, 1819, lat. $39^{\circ} 12'$ N., long. $63^{\circ} 52'$ W., and stating that it was thrown into the sea, by Mr. James Napier, the master, for the purpose of ascertaining the true direction of the Gulf-Stream.

See, as to a bottle previously thrown from the same ship, in lat. $39^{\circ} 52'$, and long. 64° , which was afterward found on the N.W. of Ireland, note †, page 130: and, as to the current in the channels of the Azores, the note *, page 198.

rent to the southward: took in studding-sails, and hauled by the wind. At 8 a.m., the west end of St. Michael's bore N. by E. $\frac{1}{2}$ E., distant about $2\frac{1}{2}$ leagues, magnetic variation, by azimuth, at 10 h. 40m. a.m., $25^{\circ} 13'$ W., Ponta del Gada then bearing E.N.E., $\frac{1}{2}$ E., by compass, about 3 leagues.

Oct. 6.—Anchored in Ponta del Gada Roads, the cathedral bearing about N.E. by N., distant three quarters of a mile: 17 fathoms of water, sandy bottom. In these roads the thermometer stood regularly at 70° in the water, when sunk to about 8 fathoms.

Oct. 11.—At about 11 a.m., (eastward of St. Michael's,) magnetic variation, by azimuth, $25^{\circ} 2'$. On the 12th, magnetic variation, by azimuth, at about 3 h. 40 m. p.m., $24^{\circ} 59'$; at sunset, by amplitude, $24^{\circ} 54'$: course E.S.E.: winds N.N.E., and variable. In the middle watch of this day an uncommonly heavy swell came on from the northward and westward, without any increase of wind; the ship rolling bulwarks under, first on one side, and then on the other.

Oct. 13.—Winds W.S.W. and West. The heavy swell went down as the breeze freshened.

Oct. 16.—About 4h. 45m. p.m., magnetic variation, by azimuth, $21^{\circ} 48'$ W. On account of our nearing land caused the thermometer to be examined every two hours. At 8 p.m., the thermometer, in the water, dropping to 66° , showed our approach to land, or at least to soundings. At day-light the water had assumed a greenish tint, in lieu of the deep blue of the ocean. At 8 a.m. sounded, but found no bottom with 90 fathoms.

Oct. 17.—At 2 p.m., shaped a course to sight the land. Paid much attention to the thermometer. Afternoon very hazy, with small rain. At 6 p.m. made the land, and the fog clearing off for a short time, saw the Monchique Mountains. Shaped a course to clear Cape St. Vincent. Observing the thermometer gradually and rapidly sinking, ordered every person to hearken for breakers, as well as look out for land, the fog being very close. At 10h. 30m., the haze clearing, saw Cape St. Vincent about a league and a half distant. A strong inset for some time seemed to drag us near the shore, notwithstanding the course we steered and way we made through the water. The observations of this day served particularly to show the utility of the thermometer. On the 18th, at sun-set, magnetic variation, by an excellent amplitude, $22^{\circ} 29'$ W.

Oct. 19.—At sun-set, magnetic variation, by amplitude, $22^{\circ} 24'$ W. At noon, the tower on Cape Trafalgar bore E.N.E., distant about 6 leagues.

Oct. 21.—During the various tacks we have made in the Gut, it is remarkable with what precision the thermometer indicated our approach to either shore. At one a.m., saw Tariffa Light bearing about East, by compass, distant about $3\frac{1}{2}$ leagues. Tacked ship as we approached either shore, as prudence dictated.—A. L.

IMPROVED MARINE THERMOMETER.

To the preceding remarks, Captain Livingston adds, "In my thermometric experiments I had several thermometers broken, and I have heard objections made to the experiments, that, in the manner they were made, the thermometer was not immersed far enough to enter into water sufficiently uninfluenced by the heat of the solar rays: but it will be seen, by comparing the day and night observations, that this is a futile objection. However, to avoid it, secure my thermometers from being broken, and to enable me to have a column of water round the thermometer, sufficient to retain its original temperature till such time as the degree indicated by the thermometer scale could be read off, keeping at the same time the bulb of the thermometer immersed in the water, I prevailed on an ingenious mechanic to attempt the structure of such a case as I wanted, in which he has most happily succeeded."

The person here alluded to is Mr. Robert Jamieson, a partner of the firm of Gardners, Jamieson, and Co., Mathematical Instrument Makers, in Glasgow, who has been honoured with the large silver medal of the Society for the encouragement of Arts, as a public testimony of the value and utility of the invention.

DESCRIPTION.—The first figure, hereto annexed, represents the case, a tube of copper, which incloses a thermometer: the second figure represents a thermometer so inclosed. The length of the whole tube, including the lid, is about 18 inches, and its external diameter 2 inches. The lid, which has a check to fit the tube, is about 2 inches deep, and has a conical, or puppet, valve in it, which rises upward. At the lower end of the tube is another valve of the same description, which, also, rises upward; and these two valves permit the water to pass freely through the tube while it descends in the water; but, so soon as it stops, the valves shut, and the water admitted, at the greatest depth to which the machine is sunk, remains in the tube, around the thermometer.

Fig. 1. is a back view of the case ready for use. In Fig. 2, *aa* represents a ring, or collar, on which the thermometer-plate rests, to keep it clear of the lower valve: *bb*, the upper valve and valve-tube cover: *cc*, a bridge on which the neck, rod, or journal, of the valve works, through a hole in a swell in the centre of the bridge: *dd*, lower part of the journal, with a screw-head, which keeps it from rising through the hole in the bridge: *ee*, ends of the journals.

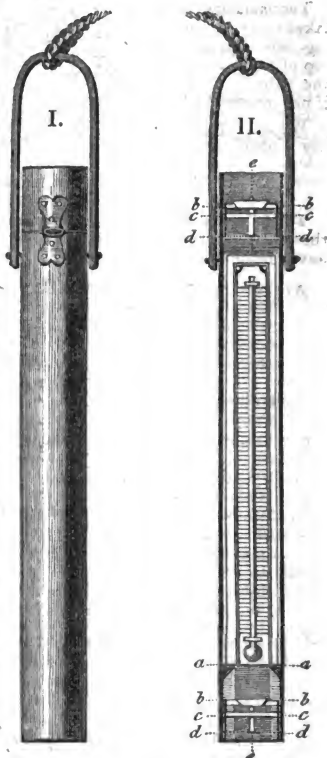
Mr. JAMIESON'S DIRECTIONS for the Use of the MACHINE are as follow:

In using the MARINE THERMOMETER-CASE, a stout line, of some fathoms in length, must be made fast to the handle of the case, which may be carried forward, and hove like the deep-sea-lead. The length it must be passed forward will depend on the velocity with which the vessel, on board of which it is used, moves through the water; but a few experiments will shew the intelligent observer what length of time is necessary to allow the mercury to rise or fall sufficiently, to indicate the true temperature of the sea. The observer must then haul up the case by the line, open the lid, and draw out the thermometer a sufficient length to allow of the altitude, as pointed out by the mercury in the thermometer-tube, being read off; but, in doing this, care should be taken always to keep the bulb of the Thermometer immersed in the water contained in the case.

In practice, the case ought to be sunk as perpendicularly as possible, in order to insure the free passage of the water through it; and care must be taken never to permit it to touch the bottom, as sand, or other substances, might get in, and render the lower valve of no use till cleaned again.

The depth to which the instrument should be sunk must depend on various circumstances, but it is apprehended a few fathoms will generally be found sufficient. Probably it may be deep enough to sink the thermometer a foot or two lower than the ship's keel; but attentive observers will hardly fail to try it both at greater and lesser depths.

The frequent use of the thermometer is earnestly recommended; and it may be interesting, at the time when the observations are made on the heat of the sea, to note corresponding ones on the temperature of the air, though this is not essentially necessary.



Thermometric observations of the temperature of both the air and water may be taken every two hours; and, for convenience, two additional columns marked upon the log-slate; the one of which, denoting the temperature of the air, entitled T.A. at the top of the column, while T.W., at the head of the other, will denote the temperature of the water. From the log-slate these observations may be copied into a private journal, if not inserted in the ship's log-book.

We are happy to find that this instrument is generally approved; and, as its great utility is obvious, expect that it will be shortly in general use.

The following STATEMENT, connected with the THERMOMETER, may be acceptable to the reader. It has been selected to fill up that part of this page which would otherwise have remained blank:

- At 600° of the scale of Fahrenheit, or the common scale, mercury boils.
- 546 oil of vitriol boils.
 - 242 spirit of nitre boils.
 - 213 cow's milk boils.
 - 212 common fresh water boils; 80° on *Reaumur's Scale*; and 100° on the *French Centesimal Scale*.
 - 190 brandy boils.
 - 175 alcohol, or spirit of wine, boils.
 - 156 serum of blood and white of eggs harden.
 - 146 kills animals in a few minutes.
 - 108 to 99, hens hatch eggs.
 - 107 to 103, heat of the skin in ducks, geese, fowls, pigeons, partridges, &c.
 - 106 heat of the skin in a common fever.
 - 103 to 100, heat of the skin in cattle, dogs, cats, &c.
 - 99 to 92, heat of the human skin in health.
 - 97 heat of a swarm of bees.
 - 90 greatest heat of the sea, (Gulf of Mexico, *August*, 1818).
 - 86 heat of the sea in the Strait of Florida. *Sept.* 1818.
 - 82 common heat of the sea near the Equator.
 - 80 heat of the air, in the shade, in very hot weather.
 - 75 to 72, temperature in which the pine-apple, cinnamon, rhubarb, &c. flourish.
 - 74 butter begins to melt.
 - 72 to 70, grapes, coffee, pimento, tamarind, &c. flourish.
 - 67 to 60, aloes, Indian-fig, capers, &c. flourish.
 - 64 heat of the air, in the shade, in warm weather.
 - 55 mean temperature of the air in England.
 - 43 oil of olives begins to stiffen, or become opaque.
 - 32 water just freezing, or snow and ice just melting. ZERO or 0 on *Reaumur's*, and on the *French Centesimal Scale*.
 - 30 milk freezes.
 - 28 urine and common vinegar freeze.
 - 20 wines, Burgundy, claret, and Madeira, freeze.
 - 0 A mixture of snow and salt, which is able to freeze oil of tartar, *per deliquium*, but not brandy.
 - 39 below 0, mercury freezes.

Various TABLES, CALCULATIONS, &c., relative to CURRENTS in the ATLANTIC OCEAN, &c.

COMMUNICATED BY CAPTAIN LIVINGSTON.

Currents experienced in the Strait of Florida, by Don Francisco Alcedo, of the Spanish Navy, in March, 1795. From the 'Derrotero de las Antillas.'

Year, Month, & Day.	Latitude.	Longitude.	Set of Current.	Hourly Velocity.
1795—March {	23 9 26	82 17 37	North ...	0.75 mile.
	2 24 14 0	81 25 0	E.N.E. ...	3.85 ditto.
	3 24 42 0	80 13 0	N. 16° E.	4.08 ditto.
	4 26 55 0	79 35 0	N. 2° E..	4.03 ditto.
	5 29 9 0	79 15 0		

Currents experienced in the Strait of Florida, in the Brig Dispatch, of New Orleans, by Andrew Livingston, Mate of the Dispatch.

Year, Month, & Day.	Latitude.	Longitude.	Set of Current.	Hourly Velocity.
1819—Mar. {	9 23 17 0	81 40 0	E.N.E. ..	2.10 miles.
	10 24 23 0	80 42 0	N. 56° E.	1.46 ditto.
	11 25 0 0	80 2 0	N. 19° E.	1.42 ditto.
	12 26 46 0	79 16 0	N. 4° E..	1.33 ditto.
	13 28 0 0	79 12 0		

Currents experienced in the Gulf of Mexico and Strait of Florida, by Andrew Livingston, Master of the Ship Asia, of Scarborough, 1818.

1818—June {	27	23 17 0	82 40 0	S. 52° E..	2.92 miles.
	28	24 40 0	83 51 50	South.....	0.13 ditto.
	29	26 37 0	85 23 15		
1818—Sept. {	5	25 17 0	85 6 0	N. 4° W..	1.87 miles.
	6	25 19 0	84 21 0	S. W.	0.03 ditto.
	7	24 32 0	83 38 0	S. 45° E..	1.71 ditto.
	8	23 27 0	82 28 0	N. 75° E.	2.42 ditto.
	9	24 11 0	80 41 0		
	10	No obs.	.....	N. 4° 30' E.	{ 3.35 ditto, for 2 days.
	11	27 30 0	79 35 0	N. 2° .. E.	3.66 miles.
	12	28 43 0	79 23 0	N. 4° .. E.	3.25 ditto.
	13	31 16 0	79 30 0		

Currents experienced in the Schooner Brilliant, of Portsmouth, New Hampshire, by Andrew Livingston, a Passenger, in the Strait of Florida.

1819—Feb. {	19	24 35 0	79 34 0	N. 60° E.	1.15 mile.
	20	23 34 0	81 24 0		

On comparing the strength of currents experienced by Don Francisco Alcedo, in March, 1795, and that found by Andrew Livingston, in the same month, in 1819, in the brig Dispatch, it will at once be perceived, that the velocity of the Gulf-Stream current is not uniform in its velocity; and also that the current is not periodical.

The northerly current experienced in the Asia, on 6th September, is worthy of remark.

Voyage of the Schooner Brilliant, of Portsmouth, New Hampshire, Captain William Tullock, from Gibraltar towards Havanna.

Year, Month, and Day.	Time of Observation.	Lat. A.	Lat. O.	Object observed for Latitude.	Long. A.	Long. O.	Objects observed for Longitude.	Set of Current.	Hourly Velocity.	Remarks.	Winds.
8 } January	6h. 37m. P.M.	35 45			6 30	6 27	♄ & * Pollux		Miles.	{ 3' E. in 6h. 37m. }	East.
	9h. 10m. P.M.	35 44	35 40	♄'s mer. alt. ....	.....	.....	.....	S. 51° E.	0.59	{ 4' S. in 9h. 10m. }	
	Noon	35 44	35 35	♄'s mer. alt.	8 56	.....	.....	.....	.....	{ 9' S. in 24h. }	
	6h. 13m. P.M.	35 33	.....	.....	9 21	9 8	♄ & * Pollux	.....	.....	{ 19' E. in 24h. }	
9 } January	11h. 16m. P.M.	35 35	35 28	* Sirius, mer. alt.						{ 7' S. in 11h. 16m. }	N.N.E.
	Noon	35 35	35 22	♄'s mer. alt. ....	.....	.....	.....	S. 37° W.	1.50	{ 13' S. in 24h. }	
	7h. 15m. P.M.	35 22	.....	.....	10 20	10 28	♄ & * Arietis	.....	.....	{ 23' W. in 25h. } Mean 20'	
	9h. 55m. P.M.	35 24	.....	.....	10 30	10 35	♄ & * Regulus	.....	.....	{ 3' E. in 24h. } in 26h.	
10 } January	Noon	35 24	35 13	♄'s mer. alt.						{ 9' S. in 24h. }	N.E.
	Noon	35 7	35 7	♄'s mer. alt.	13 5	.....	.....	.....	.....	Water supposed stationary	
	Noon	34 46	34 31	♄ by double alt.	15 41	.....	.....	S. 59° E.	1.20	{ 15' S. in 24h. }	
	10h. 15m. P.M.	34 26	.....	.....	15 54	14 54	♄ & * Aldebar	.....	.....	{ 60' E. since obs. of 10th } 14' S. in 24h.	
11 } January	Noon	35 51	35 37	♄'s mer. alt.	16 51						N. by W.
	6h. P.M.	33 4	.....	.....	.....	16 13	{ Contd. from } { last obs. ... } { Bearings of } { land ... }	.....	.....	.....	
	Noon	32 9	31 56	♄'s mer. alt.	16 57	16 51	.....	S. 20° E.	0.55	{ 13' S. and 6' E. in 24h. }	
	Noon	.....	.....	.....	.....	.....	.....	.....	.....	.....	

As the longitude by account and observation differed very little at 7h. 15m. and 9h. 55m. P.M. of January 10th, and as the latitude by account and the latitude observed exactly agreed at noon of the 11th, it is presumed, the effects of the currents had balanced, or nearly so, at that time, and that the waters were then stationary; which has been assumed as correct in the statement of the currents. As, from many circumstances, it seems more likely to be accurate when calculating the currents from noon of the 11th to 10h. 15m. P.M. of the 13th, than from noon to noon, for the forty-eight hours, it follows, (calculating on that principle,) that the current's direction was S. 68° E. distance 53 miles, in 34½ hours, or about 1.59 miles per hour.

In reference to the subsequent Tables, it may be observed that, on the days omitted in the Abstract, no current was perceptible, or it was too slight to require record. From the 24th to the 28th of January, the winds were chiefly from the East. On the 5th and 6th of February, variable and southerly.

	Lat. A.	Lat. O.	Diff.	N or S	Lon. A	Lon. O.	Diff.	E or W	Objects observed for Longitude.	Set of Current	Velocity of Current.	Remarks, &c.	Winds.
1819.	15	30° 24'	30° 24'		19° 19'								S. E.
	16	28 35	28 36	1'	N.	22 0							S. E. by S.
	17	27 44	27 44			22 50							S. E. by S.
	18	27 2	27 0	2	S.	23 25	22° 39'	46"	E.	S 88° 30' E.	41 miles in 4 days		Variable.
January	19	26 1	26 2	1	N.	24 2	23 20	42	E.	N. 70° W.	5 miles in 24 hrs.	1° S. & 46' E. in 4 days.	E. S. E.
	20	25 28	25 15	13	S.	25 24	24 41	43	E.	S. 1° E.	13 miles in ditto	1° N. & 4' W. in 24 hours.	E. S. E.
	21	25 8	24 58	10	S.	27 44	27 10	34	E.	S. 38° W.	13 miles in ditto	10° S. & 1' E. in ditto.	N. E. by N.
	22	25 4	24 58	6	S.	29 58	29 22	36	E.	S. 18° E.	6 miles in ditto.	10° S. & 9' W. in ditto	E. N. E.
	23	25 2	24 56	6	S.	32 58						6° S. & 2' E. in ditto	E. by S.
	29	24 42	24 42			49 55	48 22	1° 33'	E.	S. 77° E.	7.70 miles per day		East.
	30	24 54	24 55	1	N.	52 20	50 23	1 57	E.	N. 87° 30' E.	22 miles in 24 hrs.	12° S. & 57' E. in 7 days	E. by S.
	31	24 59	no obs.			53 36	51 37	1 59	E.			1° N. & 24' E. in 24 hours	South.
Feb.	1	24 54	24 46	8	S.	55 26						2° E. in 24 hours	S. S. W.
	2	24 51	24 55	4	N.	57 14	55 26	1 48	E.	S. 68° W.	11 miles in 48 hrs.	4° N. in ditto, & 11' W. in 48 h.	Variable.
	3	24 36	24 24	12	S.	58 0	56 12	1 48	E.	South.	12 miles in 24 hrs.	12° S. in ditto.	West.
	4	23 59	23 58	1	S.	59 53	57 47	2 6	E.	S. 80° E.	16 miles in ditto	1° S. & 18' E. in 24 hours.	N. by E.
	7	24 35	24 11	24	S.	64 0	61 53	2 7	E.	} S. 13° W.		84° S in 24 hrs. & 1' E. in 3 d.	Variable.
	8	24 27	24 17	10	S.	66 59	65 1	1 58	E.		35 m. in 48 hrs.	10° S. & 9' W. in 24 hours.	North.
	9	24 34	24 34			68 56	66 59	1 57	E.			1° W. in 24 hours	N. N. E.
	10	24 48	24 51	3	N.	70 45	68 39	2 6	E.	N. 70° E.	9 miles in 24 hrs.	3° N. & 9' E. in 24 hours	E. S. E.
	11	25 18	25 26	8	N.	71 30						8° N. in 24 hours	S. S. E.
	12	25 44	25 34	10	S.	73 5	71 5	2 0	E.	S. 72° W.	7 miles in 48 hrs.	10° S. in ditto.	N. N. E.
Feb.	13	25 59	25 57	2	S.	75 58							S. S. E.
	14	26 8	no obs.			77 22	74 44	2 38	E.	} S. 78° E.	46 m. in 3 days	9° S. & 50' E. in 3 days.	S. S. W.
	15	25 48	25 41	7	S.	78 50	76 0	2 50	E.				E. S. E.
	16	25 42	25 42			80 16	77 1	3 15	E.	East.	22 1/2 m. in 24 hours	25° E. in 24 hours	E. N. E.
	17	25 47				77 12			Contd. by D. R. from last obs.			Hole in Rock, true N. 4 m.	East.
	1819.	18	25 47			77 12							East.

On the 7th of Feb., the 1st observation of ☉ and * Regulus was taken, at 7 h. 34 m. 53 s., and the 2d at 7 h. 47 m. 21 s. At 12 h. 14 m. 26 s., the Δ distance of ☉ and * Aldebaran gave results which very nearly coincided with the two previous observations by ☉ and Regulus. At 9 h. 27 m. P. M., the latitude was $24^{\circ} 23'$, by the meridian altitude of the Moon. The current's set and velocity were calculated for the 48 hours, ending at noon of the 8th, as stated in the table; but it seems really to have set almost due South on the 7th, and with fully double the velocity which it possessed on the 8th. The above Table exhibits the fact of an easterly current setting with some force from the Providence Channel.

	Lat. A.	Lat. O.	Diff.	N or S	Lon. A.	Lon. O.	Diff.	E or W	Objects obs. for Longit.	Set of Cur.	Velocity of Current.	Remarks, &c.	Winds.
1819.	28° 0'	28° 0'	...	...	79° 12'	...	...	...	Long. from bearings and distance corrected	...	of the W. Cape for currents.	of the Great Bahama,	N.E. by the W. to S.W.
13	28° 0'	28° 0'	...	...	79° 12'	...	...	...	24h. before, and D.R.	...	...	...	West.
14	28 21	28 18	3'	S.	77 18	...	...	...	...	...	...	...	N.N.E.
15	28 31	28 27	4	S.	76 30	...	...	...	...	...	...	...	S.E.
16	29 11	29 5	6	S.	75 15	...	...	...	...	...	...	A fresh gale.	W.N.W.
17	28 58	28 52	6	S.	75 32	...	...	...	...	...	...	...	N. by E.
18	29 4	29 3	1	S.	75 13	...	...	...	...	...	...	...	Variable.
19	29 40	29 36	4	S.	74 39	...	...	...	...	...	...	...	South.
20	29 44	29 43	4	N.	72 32	71° 18'	1° 14'	E.	⊙ & ☽, 3 excellent sights	S. 73° E.	9.71 miles per day	20° S. and 74° E. in 7 days	South.
21	29 40	29 42	2	N.	70 43	...	...	...	...	...	...	...	South.
22	28 54	no obs.	...	...	69 28	...	...	...	...	...	...	...	N.N.E.
23	28 29	28 30	1	N.	69 32	...	...	...	...	...	...	...	N.E. by E.
24	28 36	28 36	...	...	69 40	...	...	...	...	...	...	...	E.S.E.
25	28 49	29 1	12	N.	69 34	...	...	...	...	...	...	...	S.E.
26	29 13	29 13	...	...	68 17	...	...	...	...	...	...	...	S.S.E.
27	29 16	29 16	...	...	66 34	...	...	...	...	...	...	...	S. by W.
28	29 11	no obs.	...	...	64 55	...	...	...	...	...	...	...	W.S.W.
29	28 37	28 31	6	S.	63 39	...	...	...	...	...	...	...	N. by E.
30	29 0	29 4	4	N.	63 31	62 49	0 32	E.	⊙ & ☽, two sets	N. 67° W.	3.9 miles per day	{ 19° N. — 4° S. = 13° N. } and 42° W. in 10 days	N.E. by E.
31	30 2	30 11	9	N.	62 57	...	...	...	...	...	...	...	E.S.E.
1	30 55	31 3	8	N.	61 49	61 39	0 10	E.	☽ & * Regulus	N. 49° W.	26 miles in 48 hrs.	17° N. and 22° W. in 2 days	S.S.E.
2	30 44	31 28	16	S.	61 0	60 26	0 34	E.	⊙ & ☽	S. 53° E.	1.12 miles per hr.	16° S. and 24° E. in 24 hours	S.E. by S.
3	31 46	31 45	1	S.	59 52	...	...	...	...	...	...	...	South.
4	31 13	31 17	4	N.	58 45	...	...	...	...	...	...	...	North.
5	31 3	31 2	1	S.	57 40	56 25	1 15	E.	⊙ & ☽	N. 86° E.	11 miles per diem	4° N. — 2° S. = 2° N. & 39° E.	N.E.
6	31 2	31 2	...	...	56 57	...	...	...	...	...	...	...	N.N.E.
7	31 7	31 6	1	S.	56 0	...	...	...	...	...	...	...	Variable.
8	31 12	31 2	10	S.	54 3	...	...	...	...	...	...	...	North.
9	30 37	30 34	3	S.	53 14	...	...	...	...	...	...	...	Last.
10	30 49	30 49	...	...	51 47	...	...	...	...	...	...	...	S.S.E.
11	31 1	31 3	2	N.	49 36	...	...	...	...	...	...	...	W. by S.
12	31 32	31 32	...	...	47 36	46 32	1 4	E	☽ & * Regulus	S. 53° W.	2.14 mls. per diem	{ 14° S. — 2° N. = 12° S. } and 9° W. in 7 days	N.W. by N.

Mar

April

	Lat. A.	Lat. O.	Diff.	N. or S.	Lon. A.	Lon. O.	Diff.	E. or W.	Objects obs. for Longit.	Set of Curr.	Velocity of Current.	Remarks, &c.	Winds.
1819.	16 32°30'	32°39'	9'	N.	39°11'	38°11'	1° 0'	E.	☉ & ☽	N. 40° W.	5 miles in 4 days	5' N.—1' = 4' N. & 4' W.	W.S.W.
	17 33 6	33 8	2	N.	37 0	36 0	1 0	E.	☉ & ☽	N. 23° W.	4 miles in 2 days	4' N. & 2' W. in 2 days	W.S.W.
	18 33 43	33 45	2	N.	34 44	33 46	0 58	E.	☉ & ☽	N. 73° E.	17 miles in 2 days	5' N. & 19' E. in 2 days.	West.
	19 34 28	34 33	5	N.	32 37	31 2	1 17	E.	☉ & ☽	.....	.....	.....	West.
April	20 34 45	34 45	...	N.	32 19	31 2	1 17	E.	☉ & ☽	.....	.....	.....	S.W. by W.
	21 35 45	35 47	2	N.	30 18	...	...	...	.....	.....	.....	.....	Variable.
	25 35 42	35 47	5	N.	25 33	...	...	...	.....	.....	.....	.....	S.W.
	26 35 47	35 45	2	N.	24 0	...	...	...	.....	.....	.....	.....	West.
	27 35 38	35 39	1	S.	22 54	21 35	1 19	E.	☽ & * Pollux	S. 39° E.	24 miles in 7 days	10' S.—8' N. = 2' S. & 2' E.	West.
	28 35 48	35 44	4	S.	19 51	17 45	2 06	E.	☉ & ☽	S. 82° W.	58 miles in 2 days	8' S. & 70' W. in 2 days!!!	N. by E.
	29 36 15	36 11	4	S.	17 45	17 36	0 9	E.	☉ & ☽	.....	.....	.....	N. by E.
	30 36 23	36 23	...	N.	15 58	...	...	...	.....	.....	.....	.....	West.
	1 36 9	36 10	1	N.	14 55	...	...	...	☉ & ☽ * Spica & Pollux	N. 81° W.	13 miles in 3 days	2' N. & 15' W. in 3 days	W.S.W.
	2 35 47	35 48	1	N.	13 50	13 56	0 6	W.	☉ & ☽ * Spica & Pollux	S. 74° E.	1.41 miles per hr.	9' S. & 34' E. in 24 hours	W.N.W.
	3 35 53	35 44	9	S.	11 45	11 11	0 34	E.	.....	.....	.....	.....	N.W.
	4 35 48	35 44	4	S.	10 23	...	...	...	☉ & * Pollux & Spica	S. 79° W.	26 miles in 2 days	5' S. & 32' W. in 2 days	North.
May	5 35 48	35 47	1	S.	9 38	9 36	0 2	E.	☉ & * Pollux	S. 85° W.	12 miles in 24 hrs.	1' S. & 17' E. in one day	N. by E.
	6 35 37	35 36	1	S.	8 53	8 36	0 17	E.	* ☽ * Regulus & Antares	West...	5 miles in 24 hrs.	6' W. in 24 hours.	N.N.E.
	7 35 34	35 34	...	.....	8 12	8 1	0 11	E.	* ☽ * Regulus & Antares	North...	1 mile in 24 hrs.	.....	N.N.E.
	8 35 30	35 31	1	N.	7 6	6 55	0 11	E.	By bearings of the lead	South...	11 miles in 16 hrs.	.....	N. by W.
Atth. a.m.	9 36 58	35 47	11	S.	6 14	6 3	0 11	E.	.....	.....	.....	{ Cape Spotted E.S.E. by compass, 3 leagues }	N. by W.

The strong westerly current, noticed at noon of the 29th of April, appears very remarkable: had it been East in place of West, it would not have been so much to be wondered at. From eight observations for latitude, on the 9th of May, it appeared plainly, the 11' S. was principally caused by a tide.

The preceding analysis of the Dispatch's journal corroborates the fact noticed at the end of the Tables constructed from the journal of the Brilliant's voyage, of an easterly set or current, to the northward of the Bahamas.

	Lat. A.	Lat. O.	Diff.	N or S.	Lon. A.	Lon. O.	Diff.	E or W.	Objects observed for Long.	Set of Curr.	Velocity of Current.	Remarks, &c.	Winds.	
1818.	12	28° 43'	28° 43'	N.	79° 23'	79° 23'	0	W.	Long. corrected for cur- [rents.]	.....	.....	80° 11'	This additional column, entitled Long. used, contains that which was picked off each day at noon, by Andrew Livingstone, on the Chart; and it is to be remarked that, during the most of this time, he was so sick with fever, as to be unable to quit his bed. Lat. & Long. obs on 21st, at noon, assumed as a fresh departure.	N.E. E. by N. E.S.E. E.S.E. S.E.
	13	29 49	31 16	N.	79 37	79 37	0	W.	.....	.....	.....	80 3	.....	E.S.E.
	14	30 34	31 31	N.	79 33	79 33	0	W.	.....	.....	.....	78 15	.....	S.E.
	15	32 24	32 52	N.	79 13	79 13	0	W.	.....	.....	.....	76 3	.....	South.
	16	33 21	33 44	N.	78 8	78 8	0	W.	.....	.....	.....	73 4	.....	S.S.W.
Sept.	17	35 7	no obs.	N.	72 45	72 45	0	W.	.....	.....	.....	69 45	.....	S.S.E.
	18	35 27	36 25	S.	70 41	70 41	0	W.	.....	.....	.....	67 39	.....	S.S.E.
	19	36 46	36 37	S.	68 17	68 17	0	W.	.....	.....	.....	65 30	.....	S.S.E.
	20	37 38	no obs.	N.	65 36	65 36	0	E.	.....	.....	.....	62 30	.....	W.S.W.
	21	38 4	38 56	N.	62 40	62 40	2° 56'	E.	☉ & ♀ two sets,.....	N. 29½° E.	32.77m. per day	.....	.....	W.S.W.
Sept.	22	38 48	38 56	N.	60 16	60 16	0	W.	.....	.....	.....	.....	.....	West.
	23	39 2	39 4	N.	56 59	58 16	1 17	W.	☉ & ♀ two sets,.....	N. 80° W.	61 miles in 2 days	.....	.....	West.
	24	39 13	39 20	N.	53 23	55 8	1 47	W.	☉ & ♀ two sets,.....	N. 74° W.	26 miles in 24 hrs.	.....	.....	W. ½ W.
	25	39 27	39 24	S.	49 43	51 35	1 52	W.	☉ & ♀ two sets,.....	S. 61° W.	6 miles in 24 hrs.	.....	.....	West.
	26	39 37	39 37	N.	46 57	47 51	0 54	W.	☉ & ♀ two sets,.....	East,.....	45 miles in 24 hrs.	.....	.....	S.W. by W.
Oct.	27	39 53	40 8	N.	43 32	43 32	0	W.	.....	.....	.....	.....	.....	S.W. by S.
	1	39 13	39 23	N.	31 38	31 38	0	W.	.....	.....	.....	.....	.....	S.W.
	2	38 48	38 58	N.	28 23	28 23	0	W.	.....	.....	.....	.....	.....	West.
	3	38 22	38 13	S.	26 22	26 57	0 35	W.	♂ & ♀ Antares,.....	N. 28° E.	32 miles in 7 days	.....	.....	N.N.E.
	4	37 52	37 40	S.	24 43	25 39	0 56	W.	By bearings of land....	S. 55° W.	20 miles in 24 hrs.	.....	.....	Variable.
Oct.	5	37 45	37 40	S.	24 4	25 9	1 5	W.	Ditto	S. 62° W.	10 miles in ditto	.....	.....	E. by N.
	9	37 59	38 6	N.	25 49	25 42	0 7	E.	By bearings of land....	N. 39° E.	9 miles in 48 hrs.	.....	.....	E. by N. to West.
	10	38 13	38 13	N.	25 24	25 24	0	W.	.....	.....	.....	.....	.....	N. by W.
	11	38 20	38 9	S.	22 45	22 45	0	W.	.....	.....	.....	.....	.....	West.
	13	38 21	38 16	S.	17 43	17 43	0	W.	.....	.....	.....	.....	.....	S.W.
Oct.	14	37 54	38 2	N.	13 43	13 43	0	W.	.....	.....	.....	.....	.....	S.W. by S.
	15	37 26	38 5	N.	9 56	10 45	0 49	W.	* ♀ Fomalhaut & Aldebaran ...	N. 49° W.	58 miles in 6 days	.....	.....	N.E.
	16	37 44	37 4	N.	8 9	9 8	0 59	W.	Bearings of C. St. Vincent	N. 22° W.	22 miles in 48 hrs.	.....	.....	N.E.
	17	36 27	36 25	S.	7 31	7 31	0	W.	.....	.....	.....	.....	.....	N.E. by E.
	18	35 53	35 47	S.	6 21	7 0	0 39	W.	* ♀ Arietis & Pollux	S. 76° W.	33 miles in 48 hrs.	.....	.....	E.N.E.
Oct.	19	36 2	36 4	N.	5 51	6 20	0 39	W.	* ♀ same objects,...	South ...	2 miles in ditto	.....	.....	E. by S.
	20	36 2	36 4	N.	5 51	6 20	0 39	W.	.....	N. 60° E.	2 miles in ditto	.....	.....	E. by S.

line above analysis of the Journal of the Asia is divided into four parts, each of which commences from a new point of departure.

In the First Part, the southerly set of g' on the 19th Sept. seems the most remarkable circumstance. In the Second Part, the westerly currents noticed on the 23d, 24th, and 25th, of September, appears completely contrary to the generally received notions relative to the set of the currents thereabout. From the observations of 26th September, the current seems again suddenly to have taken an easterly direction. The westerly set may perhaps have been some eddy, formed by the General Gulf-Stream Current, either in consequence of its being checked by the Banks of Newfoundland, or, caused by some unknown bank or danger. It is to be remarked, also, that it occurred near the time of the equinox, and also about the period when a heavy gale, approaching almost to a hurricane, was felt at Bermuda.

On the 3d of October the Asia passed, during the night, through the channel between the islands of Pico and St. George's; the master having been induced to take this course, in consequence of the wind's heading the ship off when shaping a course to the southward of Fayal.

The currents on the 3d, 4th, and 5th, of October, were perhaps occasioned principally by the tides around the Azores.

The 6th, 7th, and 8th, of October are omitted as uninteresting, the ship having been either at anchor, or sailing near to the shore of St. Michael's. The very strong northerly set experienced from 13th to 17th of October, at 10h. 30m. *p.m.*, if prevailing constantly or even frequently, might probably be of use to vessels bound to the northward, on the coast of Portugal, where the winds are so frequently from the northward.

The last part, as well as the tables constructed from the Journals of the Dispatch and Brilliant, shew that a westerly set sometimes prevails at only a short distance from the Gut of Gibraltar.

GENERAL REMARKS.

Surplus effects of currents on the schooner Brilliant, from 8th to 14th of April, both inclusive, and from Lat. $35^{\circ} 48' N.$, Long. $5^{\circ} 54' W.$, to Lat. $32^{\circ} 9' N.$, Long. $16^{\circ} 51' W.$ = $1^{\circ} 13'$ of Lat. S., and $1^{\circ} 1'$ of Long. E. = Current's direction, S. $34^{\circ} E.$, 90 miles in 7 days, or nearly 12.86 miles per day.

Surplus effects of currents on same Schooner, from Lat. $31^{\circ} 56' N.$, Long. $16^{\circ} 51' W.$, to Lat. $25^{\circ} 47' N.$, Long. $77^{\circ} 12' W.$ in 34 days, from 15th January to 17th February, both days inclusive, $1^{\circ} 58' S.$, and $3^{\circ} 15' E.$ = Current's course, S. $55^{\circ} \frac{1}{2} E.$, 210 miles, or nearly 6.18 miles per day.

Total surplus effects of currents on the Brilliant during 41 days, from Cape Spartel in Africa, to the Hole in the Rock in the Bahama Islands, = Current's course, S. $49^{\circ} 30' E.$ 294 miles distance, or about 7.17 miles per diem.

Surplus effect of currents on the Brig Dispatch in 58 days, from Lat. $21^{\circ} 00' N.$, Long. $79^{\circ} 12' W.$, to Lat. $35^{\circ} 47' N.$, Long. $6^{\circ} 3' W.$, from 13th March, to 9th May, 1819 = Current's course, S. $17^{\circ} E.$ 38 miles distance.

Surplus effects of currents on the ship Asia, in 9 days, from 13th to 21st September, 1818, both days inclusive, and from Lat. $28^{\circ} 43' N.$ Long. $79^{\circ} 23' W.$, to Lat. $38^{\circ} 56' N.$, Long. by angular distances of $\odot$ and $\odot$ $62^{\circ} 40'$ = Current's course, N. $29\frac{1}{2}^{\circ} E.$, 296 miles distance, or about 32.77 miles per diem.

Surplus

Surplus effects of currents on the same ship, in 14 days, from 22d September to 5th October, both days inclusive, and from Lat. $38^{\circ} 56' N.$, Long. $62^{\circ} 40' W.$, to Lat. $37^{\circ} 40' N.$, Long. $25^{\circ} 9' W.$ = Current N. $66^{\circ} \frac{1}{2} W.$, distance 56 miles, or 4 miles *per diem*.

Surplus effects of currents on same ship, in about $7\frac{1}{2}$ days, viz. from 9th October to 10h. 30m *p.m.* of 17th October, and from Lat. $38^{\circ} 6' N.$, Long. $25^{\circ} 42' W.$, to Lat. $37^{\circ} 4' Long.$, $9^{\circ} 8' W.$ = Current N. $37^{\circ} W.$, distance 72 miles in $7\frac{1}{2}$ days (10h. 30m. being assumed as $\frac{1}{2}$ day,) or about 9.60 miles *per diem*. It seems probable the greater part of the effects of this latter current were felt in the last four days.

The 4th part of the above table, constructed from the Asia's Journal, will best explain the effects of the currents from Cape St. Vincent to the Gut of Gibraltar, as experienced in that ship.

In making up these Tables, all the Lunar Observations have been re-examined, and some of the single sets recalculated, and the result has been, that even more confidence than before has been placed in them.

The entire calculations of many of the Lunars, and the elements of all of them, excepting that of the 3d October, ($\odot$ & $\star$ Antares,) are inserted in Andrew Livingston's Journals.

The notice taken of very small differences, is not from an affectation of extreme accuracy, but to shew that even these have not been overlooked, though it is highly probable they may have arisen from bad steerage, improper allowances for magnetic variation, or errors in the observations.

The winds were not embraced in the first sketch of the preceding Tables, but were subsequently inserted, taking the general mean point for the 24 hours from the Journals, without correcting for magnetic variation. Nor has, indeed, any rigid attention been paid to the exact point inserted, as it was done from merely a glance of the eye over each day's journal.

Throughout these Tables, the nearest minute of Latitudes and Longitudes has been inserted.

The easterly current to the northward of the Bahamas seems to have ceased about the meridian of 73° west of Greenwich.

It has been a subject of much regret to *A. L.* that he had not the advantage of Chronometers.

IX.—OF THE MARINE BAROMETER AND SIMPIESOMETER.

THE MARINE BAROMETER is an instrument too well known to require description. Captain Horsburgh says, "This is a very useful instrument in *high latitudes*, by assisting navigators to anticipate approaching storms. Previous to a hard gale of wind there is generally a great fall of the mercury, and, even *near the tropics*, the fall of it, before a storm or hurricane, is usually considerable. Within 9° or 10° of the equator there seldom, or never, is a hurricane or storm of *long duration*; but whirlwinds and hard squalls, of a *few* hours continuance, are sometimes experienced within these parallels of latitude without any fall of the mercury. Indeed the barometer is of little use as a guide in prognosticating storms which may happen within the tropics, except before a severe hurricane, when there is often a considerable fall of the mercury, the latitude being not less than 14° or 15° North or South.

"It is proper to observe that, in the open ocean, between the tropics, in settled weather, there is a *flux and reflux* in the atmosphere, twice every twenty-four hours, resembling the tides in the sea; but these atmospherical tides depend upon the sun's influence and the rotation of the earth, and do not follow the motion of the moon. The rise and fall of the mercury, in consequence of these tides, is about 6 or 7 of the hundred parts of an inch, in settled weather, near the equator; the high station happening about 11 o'clock in the morning and 11 o'clock at night, and the low station about 5 o'clock in the morning and evening. The regularity of this flux and reflux of the atmosphere is *obstructed by land*, but, in the ocean, it prevails to latitude 26° North and South; and, in fine steady weather, it may be perceived as far as lat. 30° or 32° North and South. In high latitudes, the motion of the mercury in the barometer, like the winds, is mutable and uncertain; but, previous to a storm, or gale of wind, there is commonly a great fall, and the mercury begins to rise before the conclusion of the gale; sometimes even at its commencement, as the equilibrium in the atmosphere begins to be restored.

"Although the mercury sinks lowest before high winds, it frequently sinks considerably before a heavy fall of rain; and, when the mercury stands low, the air is light, and deprived of expansibility or elasticity, therefore not capable of supporting much gaseous moisture; at such periods, consequently, rain generally falls. The mercury, also, sinks on the approach of thunder and lightning, or when the atmosphere is highly charged with electric matter.

"In serene settled weather, the mercury commonly stands high, also in clear frosty weather. The mercury, in the open sea, is in general inclined to rise with easterly, and fall with westerly, winds. It is likewise necessary to remember that, in the northern hemisphere, in the open sea, the mercury rises with northerly, and falls with southerly, winds; because the former, coming from the frozen parts, near the Pole, are more dense than the latter, which blow from the equatorial regions. In the southern hemisphere, the contrary takes place; for there the mercury rises with the cold southerly winds, and falls with northerly winds. These effects are more particularly observed in high latitudes, on the ocean; for obstructions and irregularities will always happen near land: because there the rarefaction and expansibility of the atmosphere are not so equal as over the ocean.

"After very warm and calm weather, in winter particularly, a storm is likely to follow; or at any time that the atmosphere is *greatly heated* above the medium temperature.

"By proper attention to the marine barometer, the experienced navigator may often be enabled to anticipate the changes of weather; and, in some seas, he may, by its indications, even take in or let out reefs in the night. It is also advisable to observe the phases and progress of the moon; for it is reasonable to suppose that the influence of that planet upon the atmosphere must be considerable in penetrating through it to the surface of the ocean."

In brief, a change of weather seldom fails to be indicated by the least rising or falling of the mercury in the barometrical tube: the descent in tropical latitudes, of an eighth of an inch, when at a distance from the land, is the unequivocal indication of an approaching

proaching storm. Many a ship has been saved from destruction by the timely notice given by this instrument to prepare for a storm, and *no ship should be permitted to go to sea without one.*

The SIMPIESOMETER is an improved air-barometer, invented by Mr. Alexander Adie, F.R.S., Ed., who has given a description and figure of it in the *Edinburgh Philosophical Journal*, Vol. I. page 54. One of the first which was made was sent from the Clyde, in the ship *Buckinghamshire*, on her voyage to the East-Indies, 1816; and the following is the report given of the instrument, by the late Captain Christian, the commander, on his return.

“ I am glad to say that I consider your barometer a valuable instrument at sea, having given it a fair trial on the outward passage to India, by keeping a correct register of it, as well as of the common Marine Barometer, taken every third hour, night and day, during the passage; and I not only found that it was fully as sensible of the changes of the atmosphere as the other barometer, but that it had a great advantage over all barometers I have ever seen used at sea, namely, that of not being, in the smallest degree, affected by the motion of the ship, which will often make the quicksilver in the common tube plunge, or rise and fall, in such a degree, as to make it very difficult to come within at least one or two tenths of an inch of the truth, even in the largest ships. On the passage home, I also found it very correct in the indication of the winds and weather.”

Lieut. Wm. Robertson, who was on the Northern expedition of 1818, has said of it, “ The Simpiesometer is a most excellent instrument, and shews the weather far better than the Marine Barometer. In short, the barometer is of no use compared to it. If it has any fault, it is that of being too sensible of small changes, which may frighten a reef in, when there is no occasion for it; but, taking it altogether, in my opinion, it surpasses the mercurial barometer as much as the barometer is superior to having none at all.”

The Simpiesometer has also been tried on board the yacht of the Commissioners of Northern Lighthouses; and Mr. Stevenson, the engineer, has given his attestation of its superiority. Mr. Stevenson says that, “ Having occasion, towards the conclusion of his voyage, in September, 1819, to visit the Isle of Man, he beheld the interesting spectacle of about 300 large fishing-boats, each from 15 to 20 tons burthen, leaving their various harbours at that island, in an apparently fine afternoon, and standing directly out to sea, with the intention of prosecuting the fishery under night. He, at the same time, remarked, that both the common marine barometer, and Adie's Simpiesometer, which were in the cabin of the vessel, indicated an approaching change of weather, the mercury falling to 29.5 inches. It became painful, therefore, to witness the scene: more than a thousand industrious fishermen, lulled to security by the fineness of the day, scattering their little barks over the face of the ocean, and thus rushing forward to imminent danger, or probable destruction. At sun-set, accordingly, the sky became cloudy and threatening; and, in the course of the night, it blew a very hard gale, which afterwards continued for three days successively. This gale completely dispersed the fleets of boats, and it was not without the utmost difficulty that many of them reached the various creeks of the island. It is believed no lives were lost on this occasion; but the boats were damaged, much tackle was destroyed, and the men were unnecessarily exposed to danger and fatigue. During the same storm, it may be remarked, thirteen vessels were either totally lost or stranded, between the Isle of Anglesea and St. Bee's Head, in Lancashire. Mr. Stevenson remarks, how much it is to be regretted that the barometer is so little in use in the mercantile marine of Great Britain, compared with the trading vessels of Holland; and observes that, though the common marine barometer is perhaps too cumbersome for the ordinary run of fishing and coasting vessels, yet Adie's Simpiesometer is so extremely portable, that it might be carried even in a Manx boat. Each division of such vessels has a commodore, under whose orders the fleet sails: it would, therefore, be a most desirable thing that a Simpiesometer should be attached to each commodore's boat, from which a preconcerted signal of an expected gale, or change of weather, as indicated by the Simpiesometer, could easily be given.”

As connected with this subject, the indications of a change of weather, we annex a description of SQUALLS, from the work of the distinguished navigator to whom we are indebted for the leading paragraphs of the present section.

"SQUALLS are generally of THREE kinds: that called the **ARCHED SQUALL** is frequently experienced, and usually rises up, from the horizon, in the form of an arch; but, sometimes, it assumes the appearance of a dense black cloud, particularly when highly charged with rain or electric matter. From the time that the arch, or cloud, is first seen above the horizon, its motion is sometimes very quick to the zenith, the interval being scarcely sufficient to allow a ship to reduce the necessary sail before the wind reach her, which happens when the cloud has approached to the zenith. At other times the motion of the cloud is very slow, and not unfrequently it disappears, or is dispersed, the impulse of the wind being not then sufficient to reach a ship. As a general rule, it may be observed that, if there be rain in these squalls preceding the wind, the latter will probably follow the rain in sudden severe gusts; whereas, if the wind precedes the rain, the squalls are seldom so furious, and terminate in moderate showers of rain. This general rule, however, is often interrupted by the operation of local causes.

"The **DESCENDING SQUALL** is not so easily discerned as the former; because it issues from clouds which are formed in the lower parts of the atmosphere, near the observer; and, when clouds are thus formed, they generally produce showers of rain, and successive squalls of wind.

"The **WHITE SQUALL** is not often experienced; but it sometimes happens near to, or within, the tropics; particularly in the vicinity of mountainous land. This squall generally blows very violently for a short time; and, as it is liable to happen when the weather is clear, without any appearance in the atmosphere to indicate its approach, it is consequently very dangerous. The only mark that accompanies it, is the white broken water on the surface of the sea, which is torn up by the force of the wind.

"SQUALLS, and also storms, are sometimes progressive, at other times regressive, when obstructed by an opposite wind; or, according as the point of greatest rarefaction is situated.

"When a squall is opposed by an opposite wind, its motion is *greatly retarded thereby*; and a ship sometimes, in this case, out-runs the squall, and overtakes other ships which are within the limits of the opposite wind.

"PROGRESSIVE WINDS, when they have an opposite wind to subdue, are frequently preceded many hours by a swell, which extends a great way before them."

AMERICAN WINDS.—With what has been said of the winds of America in our preceding pages 68, 69, &c. may be connected the incidental Remarks of *Lieutenant Hare*, on the North-westerly winds, given in page 143. The latter, founded on actual experience, tend to show that the North-west and westerly gales commence in the southern regions before they are felt in those more northerly; and that, therefore, a northerly route is, in certain cases, preferable to one more direct or southerly.

On the **NORTH-EAST STORMS** of North-America, *Dr. Franklin* made some remarks in 1760, in which he gives his reasons for thinking that they begin first, in point of time, in the S.W. parts; that is to say, the air in Georgia begins to move South-westerly before the air of Carolina, which is the next state North-eastward: the air of Carolina has the same motion before the air of Virginia, which lies still more North-eastward; and so on North-easterly through Pennsylvania, New York, New Hampshire, &c. quite to Newfoundland. These N.E. storms, he adds, are generally very violent, continue sometimes two or three days, and often do considerable damage in the harbours along the coast. They are attended by thick clouds and rain.

The Doctor illustrates his hypothesis with his usual felicity; and concludes with saying, "Thus, to produce our N.E. storms, I suppose some great heat and rarefaction of the air in or about the Gulf of Mexico; the air thence rising has its place supplied by the next more northern, cooler, and therefore denser and heavier, air; that, being in motion, is followed by the next more northern air, &c. &c. in a successive current; to which current our coast and inland ridge of mountains give the direction of N.E. as they lie N.E. and S.W." See *Works*, Vol. II. page 63, Edit. of 1809.

10. SUPPLEMENTARY REMARKS ON THE NAVIGATION OF AND FROM THE WEST-INDIES, PARTICULARLY WITH REGARD TO CURRENTS, &c., BY CAPT. T. WILSON, 1824-5.

At the beginning of October, 1824, Captain T. Wilson, in the ship *Henry Wellesley*, after touching at Madeira, was on his passage from MONTERRAT to CARTAGENA, and he says, "We found the currents setting to the eastward until we reached the meridian of 70° W., and in one twenty-four hours found the observed latitude to be 30 miles to the northward of account. After passing 70° W. and 14° N. we experienced westerly currents.

"In afterward running down from CARTAGENA to HONDURAS, in lat. 11° N. and longitude, by bearing of the land, $75^{\circ} 45'$ W., tried the current, and found it to set E. by S. three-quarters of a mile in an hour; and found, in the following twenty-four hours, the observed latitude to be 8 miles to the southward of latitude by account.

"On the 5th of October, steering N.W. and keeping a look-out for the SERRANILLA, at 2h. 30m. p.m. saw broken water, with a bright yellow sandy reef, from the fore-top-gallant-mast-head, then bearing N. by E. and at the estimated distance of 9 or 10 miles.

"The observed latitude on the previous noon was $15^{\circ} 25'$ N., and the distance run, by log, from that time until the reef came in sight, was 8 miles, on a N. $\frac{1}{2}$ W. course; allowing this, with the distance, adding two miles for northerly set, as found in the previous 24 hours, will give a corresponding latitude of the reef, as laid down in the *Colombian Navigator*, $15^{\circ} 45'$ N.

"Continued the course at N. $\frac{1}{2}$ W. true, but, at 4 p.m. saw rocks and broken water on the larboard-bow, bearing N.W. $\frac{1}{2}$ W. about $2\frac{1}{2}$ miles: the sandy reef at the same time bearing N.E. by E. $\frac{1}{2}$ E., at 11 or 12 miles, not being visible below the mizen-top.

"The rocks appeared to range about one mile and a half from N.W. to S.E., and lie at about one-third of the length of the reef from the western end of it. They shewed themselves about 5 feet above the water: the remaining part could be discerned only by the sea's breaking over it. In the space between the sandy and the rocky reef there was no appearance whatever of broken or discoloured water.

"At 5, 30, p.m. the broken water on the sandy kay was barely to be seen with the spy-glass from the mizen-top, and bearing E. $\frac{1}{2}$ S., and the rocky reef bore, at the same time, N.N.E. about two miles. At 6 p.m. the rocky reef bore E. by N. a short two miles; sounded in 7 fathoms, with a white coral bottom. With the reef bearing S.E. $\frac{1}{2}$ E. $2\frac{1}{2}$ miles, had 9 fathoms. With the broken water barely in sight from the mizen rigging, and bearing S.S.E. $\frac{1}{2}$ E. sounded in 12 fathoms. At 7, had again 12 fathoms: the ship, during all the time of sounding, going at the rate of 5 knots. At 7, 30, p.m. had 16 fathoms; and, at 8, no bottom with 50 fathoms up and down. The quality of the soundings continued the same all throughout as at the first cast.

"The dangers of the Serranilla, as described and exhibited in the Spanish charts, leave no doubt that the shoal requires much caution.

"Ships from the southward, from which quarter the reef is most likely to be approached, must be very cautious in passing its latitude in the night, however certain they may be of the longitude: for the kay, and in particular the reef, are so very low, that there would be very little chance of seeing it in the night before experiencing its ill effects. Should a ship happen to make the sandy kay first, it is recommended to keep a good look-out to the westward for the rocky reef: for, although there may be no visible dangers, some may exist, which will make it imprudent to attempt the passage until it is better known.

"The moon's distance, from two stars at 8 p.m. the same evening, gave a mean longitude of $80^{\circ} 23'$ W. Allowing, therefore, 6 miles westing from 5, 30, p.m. when the sandy reef bore E. by S. true, (estimated distance 4 leagues) and 12 miles westing for that bearing, will place the body of the sandy kay in $80^{\circ} 5'$ W. The eastern extre-

mity is assumed, from the Spanish surveys, in $79^{\circ} 49' W.$, which longitude may be confided in, as tolerably correct.

"The ship was found, by observation, to be considerably to the northward, both on the day of making, and the day after passing, the reef; supposed to be from a N.W. current; and the dead-reckoning, in five days, from 76° to $80^{\circ} W.$, and from 11° to $16^{\circ} N.$

"From not being near enough to the sandy kay, no more can be said of it than that it appeared to be a very long shining sand of no inconsiderable extent.

"After passing the intersection of $82^{\circ} W.$ and $17^{\circ} N.$, found a current which set 13 miles, by difference of observations, in 7 hours.

"After taking a departure from Ruatan for the Southern Four Kays, experienced a S.E. current; arising probably from taking the departure too far to the westward of Ruatan, it bearing at the time, by compass, East Point S. $82^{\circ} E.$ and S.W. Point S. $13^{\circ} W.$ "

REMARKS MADE ON THE PASSAGE FROM THE BAY OF HONDURAS, THROUGH THE STRAIT OF FLORIDA, TOWARDS ENGLAND, 1825.

"LEFT MAUGER KAY at 7 a.m. January 22, and at noon observed the latitude to be $17^{\circ} 54'$, which was 12 miles to the southward of dead-reckoning.

"For four days after the 22d, we stood off to the eastward with strong norths; and, on reaching in to the westward, on the 5th day, made the TRIANGLE, which shewed the dead-reckoning to be 90 miles too far to the eastward; and it was remarkable that, during the period, there was no deviation found in any one of the days between the latitude by account and observation: from this circumstance, a caution to a ship, under similar circumstances, may not be useless; for an inattention to it may prove fatal to a ship standing in during the night, which at the time may be supposed to be 100 miles off the danger.

On the 29th of January, at noon, the Island COSUMEL bore N. by E. by compass, distant at least 4 leagues; being to be seen only from the mizen-topmast head. The latitude, at the same time, was observed to be $20^{\circ} 2' N.$ The latitude of the South end, as given in the Tables at $20^{\circ} 4'$, must positively be incorrect. From the observation it was judged to be about $20^{\circ} 13' N.$ The South end the next day bore West, and the observed latitude was $20^{\circ} 16'$.

From latitude 20° and longitude 87° to $22^{\circ} 30'$ and 85° we experienced strong northerly currents, and in one 24 hours the latitude differed 42 miles. This was from latitude 21° to $22\frac{1}{2}^{\circ} N.$

In lat. $24^{\circ} N.$ and long. $87^{\circ} W.$ found a north set of 32 miles in nine hours. The difference of latitude was ascertained by meridional observations of stars.

IN THE STRAIT OF FLORIDA, from lat. 24° to lat. 25° , about longitude 80° , we experienced the usual velocity of the currents, as laid down in the charts: that is, about $3\frac{1}{2}$ miles an hour towards the N.E.: but, after reaching $25^{\circ} N.$ the current seemed to set nearly due East toward the Bahama Bank. From 25° to 26° the difference of latitude, ascertained by observation, exceeded the run by log 31 miles northing; this was in an interval of 15 hours. From latitude 26° to 28° , in an interval of thirteen hours, the difference of latitude by observation exceeded the difference of latitude by dead-reckoning by only 32 miles.

From latitude $25^{\circ} N.$ the usual velocity of the current, as marked in the chart, was carried on with the dead-reckoning until the latitude was again accurately ascertained by the sun; when the dead-reckoning, with this allowance, exceeded the observed latitude by 116 miles: that is to say, the latitude by log, with the usual allowance, was $29^{\circ} 58'$, but the observed latitude only $28^{\circ} 2' N.$

This remark may not be unworthy of notice; for, supposing the weather not to admit of an observation, all through the Strait, to ascertain the latitude, it may serve to warn a ship, under such circumstances, not to haul out too soon to the eastward, without having

run well to the northward, so as to give a good berth to the Maternillo Reef, on the consideration that the stream may have set them sufficiently to the northward: for had we, in the *Henry Wellesley*, trusted to our latitude by log, after having made the usual allowance, we should have endangered the ship on the Maternillo; but, having ascertained our latitude by sidereal observation, it warned us of our error, and may serve to shew the great utility of finding the latitude by night as well as by day, in this dangerous and critical navigation.

In running from the Strait towards Bermudas, no easterly current was experienced; on the contrary, in an interval of eight days, our observed longitude differed with longitude by log by about 40 miles to the westward: but this may have arisen from errors in the log.

Found more variation by half a point to the northward and westward of the Western Islands than is laid down in the Atlantic chart.

ERRATA AND ADDENDA.

The READER is requested to correct, with his pen, the following Errata.

- Page 14, Lat. of the River Inoon, $27^{\circ} 17'$ to be $28^{\circ} 17'$.
 19, line 8 from the bottom; Centa to be Ceuta.
 22, — 28 —————, 1822 to be 1821.
 23, — 13 —————, Road to to be Road of.
 72, — 12 *S.E. o* to be *S.E. of*.
 100, — 18 Centa to be Ceuta.

To the Experiments on Currents, page 93, may be added,

EASTERLY CURRENT TOWARDS SCOTLAND.—A bottle from the brig *Ardent*, John Duncan, master, from Hamburg to Newfoundland, 22d Sept. 1824, lat. $56^{\circ} 58'$, long. $24^{\circ} 30'$; found 12th March, 1825, on the sands of Dell, near the Butt of the Lewis, and the notice transmitted by the Agents to Lloyd's at Stornoway, 17th March.

See, also, as to the GULF-STREAM, &c. the note (*) on page 292, and the note (§) page 130.

TABLE FOR CORRECTING THE SUN'S ALTITUDE, *described on page 264.*

Obs. Alt.	Height of the Eye above the Sea in Feet.															
	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36
5° 0'	3'8	3'5	3'1	2'8	2'5	2'3	2'1	1'8	1'6	1'4	1'2	1'0	0'8	0'6	0'5	0'3
5 20	4.3	4.0	3.6	3.3	3.1	2.8	2.6	2.3	2.1	1.9	1.7	1.5	1.3	1.1	1.0	0.8
5 40	4.8	4.5	4.1	3.8	3.5	3.3	3.1	2.8	2.6	2.4	2.2	2.0	1.8	1.6	1.5	1.3
6 0	5.3	4.9	4.6	4.3	4.0	3.7	3.5	3.3	3.0	2.8	2.6	2.4	2.2	2.1	1.9	1.7
6 20	5.7	5.4	5.0	4.7	4.4	4.1	3.9	3.7	3.3	3.2	3.0	2.8	2.6	2.5	2.3	2.0
6 40	6.0	5.7	5.3	5.0	4.7	4.5	4.3	4.0	3.8	3.6	3.4	3.2	3.0	2.8	2.7	2.3
7 0	6.4	6.0	5.7	5.4	5.1	4.8	4.6	4.4	4.1	3.9	3.7	3.5	3.3	3.2	3.0	2.7
7 20	6.7	6.3	6.0	5.7	5.4	5.1	4.9	4.7	4.4	4.2	4.0	3.8	3.6	3.5	3.3	3.1
7 40	6.9	6.6	6.2	5.9	5.7	5.4	5.2	4.9	4.7	4.5	4.3	4.1	3.9	3.8	3.6	3.4
8 0	7.2	6.8	6.5	6.2	5.9	5.7	5.4	5.3	5.0	4.8	4.6	4.4	4.2	4.0	3.9	3.7
8 20	7.5	7.1	6.7	6.5	6.2	5.9	5.7	5.5	5.2	5.0	4.8	4.6	4.4	4.3	4.1	3.9
8 40	7.7	7.3	7.0	6.7	6.4	6.1	5.9	5.7	5.5	5.2	5.0	4.8	4.7	4.5	4.3	4.1
9 0	7.9	7.5	7.2	6.9	6.6	6.4	6.1	5.9	5.7	5.5	5.3	5.1	4.9	4.7	4.5	4.4
9 20	8.1	7.7	7.4	7.1	6.8	6.6	6.3	6.1	5.9	5.7	5.5	5.3	5.1	4.9	4.7	4.6
9 40	8.3	7.9	7.6	7.3	7.0	6.7	6.5	6.3	6.1	5.8	5.6	5.4	5.3	5.1	4.9	4.7
10 0	8.5	8.1	7.8	7.5	7.2	6.9	6.7	6.5	6.2	6.0	5.8	5.6	5.4	5.3	5.1	4.9
10 30	8.7	8.3	8.0	7.7	7.4	7.2	6.9	6.7	6.5	6.3	6.1	5.9	5.7	5.5	5.4	5.2
11 0	8.9	8.6	8.2	7.9	7.6	7.4	7.2	6.9	6.7	6.5	6.3	6.1	5.9	5.7	5.6	5.4
11 30	9.1	8.8	8.4	8.1	7.8	7.6	7.4	7.1	6.9	6.7	6.5	6.3	6.1	5.9	5.8	5.6
12 0	9.3	9.0	8.6	8.3	8.0	7.8	7.6	7.3	7.1	6.9	6.7	6.5	6.3	6.2	6.0	5.8
13	9.6	9.3	9.0	8.7	8.4	8.1	7.9	7.7	7.4	7.2	7.0	6.8	6.6	6.5	6.3	6.1
14	9.9	9.6	9.2	8.9	8.7	8.4	8.2	7.9	7.7	7.5	7.3	7.1	6.9	6.8	6.6	6.4
15	10.2	9.8	9.5	9.2	8.9	8.7	8.4	8.2	8.0	7.8	7.6	7.4	7.2	7.0	6.9	6.7
16	10.4	10.1	9.7	9.4	9.1	8.9	8.7	8.4	8.2	8.0	7.8	7.6	7.4	7.2	7.1	6.9
17	10.6	10.3	9.9	9.6	9.3	9.1	8.9	8.6	8.3	8.2	8.0	7.8	7.6	7.4	7.3	7.1
18	10.8	10.4	10.1	9.8	9.5	9.3	9.0	8.8	8.6	8.4	8.2	8.0	7.8	7.6	7.5	7.3
19	11.0	10.6	10.3	10.0	9.7	9.4	9.2	9.0	8.8	8.5	8.3	8.1	8.0	7.8	7.6	7.4
20	11.1	10.7	10.4	10.1	9.8	9.6	9.3	9.1	8.9	8.7	8.5	8.2	8.1	7.9	7.7	7.6
21	11.2	10.9	10.5	10.2	10.0	9.7	9.5	9.2	9.0	8.8	8.6	8.4	8.2	8.1	7.9	7.7
22	11.4	11.0	10.7	10.4	10.1	9.8	9.6	9.4	9.1	8.9	8.7	8.5	8.3	8.2	8.0	7.8
23	11.5	11.1	10.8	10.5	10.2	9.9	9.7	9.5	9.2	9.0	8.8	8.6	8.4	8.3	8.1	7.9
24	11.6	11.2	10.9	10.6	10.3	10.0	9.8	9.6	9.3	9.1	8.9	8.7	8.5	8.4	8.2	8.0
25	11.7	11.3	11.0	10.7	10.4	10.1	9.9	9.7	9.4	9.2	9.0	8.8	8.6	8.5	8.3	8.1
26	11.7	11.4	11.0	10.7	10.5	10.2	10.0	9.7	9.5	9.3	9.1	8.9	8.7	8.6	8.4	8.2
27	11.8	11.5	11.1	10.8	10.5	10.2	10.0	9.8	9.6	9.4	9.2	9.0	8.8	8.6	8.5	8.3
28	11.9	11.6	11.2	10.9	10.6	10.4	10.2	9.9	9.7	9.5	9.3	9.1	8.9	8.7	8.5	8.4
30	12.0	11.7	11.3	11.0	10.8	10.5	10.3	10.0	9.8	9.6	9.4	9.2	9.0	8.9	8.7	8.5
32	12.2	11.8	11.5	11.2	10.9	10.6	10.4	10.2	9.9	9.7	9.5	9.3	9.1	9.0	8.8	8.6
34	12.3	11.9	11.6	11.3	11.0	10.7	10.5	10.3	10.1	9.9	9.6	9.4	9.2	9.1	8.9	8.7
36	12.4	12.0	11.7	11.4	11.1	10.8	10.6	10.4	10.2	9.9	9.7	9.5	9.3	9.2	9.0	8.8
38	12.5	12.1	11.8	11.5	11.2	10.9	10.7	10.5	10.2	10.0	9.8	9.6	9.4	9.3	9.1	8.9
40	12.5	12.2	11.8	11.5	11.3	11.0	10.8	10.5	10.3	10.1	9.9	9.7	9.5	9.4	9.2	9.0
42	12.6	12.2	11.9	11.6	11.3	11.1	10.8	10.6	10.4	10.2	10.0	9.8	9.6	9.4	9.3	9.1
44	12.7	12.3	12.0	11.7	11.4	11.1	10.9	10.7	10.5	10.2	10.1	9.8	9.7	9.5	9.3	9.1
46	12.7	12.4	12.0	11.7	11.5	11.2	11.0	10.7	10.5	10.3	10.2	9.9	9.7	9.6	9.4	9.2
48	12.8	12.4	12.1	11.8	11.5	11.3	11.0	10.8	10.6	10.4	10.2	10.0	9.8	9.6	9.5	9.3
50	12.8	12.5	12.2	11.9	11.6	11.3	11.1	10.9	10.6	10.4	10.3	10.0	9.8	9.7	9.5	9.3
52	12.9	12.5	12.2	11.9	11.6	11.4	11.1	10.9	10.7	10.5	10.3	10.1	9.9	9.7	9.6	9.4
54	13.0	12.6	12.3	12.0	11.7	11.4	11.2	11.0	10.7	10.5	10.3	10.1	9.9	9.8	9.6	9.4
56	13.0	12.6	12.3	12.0	11.7	11.5	11.2	11.0	10.8	10.6	10.4	10.2	10.0	9.8	9.7	9.5
58	13.0	12.7	12.3	12.0	11.7	11.5	11.3	11.0	10.8	10.6	10.4	10.2	10.0	9.9	9.7	9.5
60	13.1	12.7	12.4	12.1	11.8	11.6	11.3	11.1	10.9	10.6	10.4	10.2	10.1	9.9	9.7	9.5
62	13.1	12.8	12.4	12.1	11.8	11.6	11.4	11.1	10.9	10.7	10.5	10.3	10.1	9.9	9.8	9.6
64	13.2	12.8	12.5	12.2	11.9	11.6	11.4	11.2	10.9	10.7	10.5	10.3	10.1	10.0	9.8	9.6
66	13.2	12.8	12.5	12.2	11.9	11.7	11.4	11.2	11.0	10.8	10.6	10.4	10.2	10.0	9.8	9.7
70	13.3	12.9	12.6	12.3	12.0	11.8	11.5	11.3	11.0	10.8	10.6	10.4	10.2	10.1	9.9	9.7
80	13.4	13.1	12.7	12.4	12.1	11.9	11.7	11.4	11.2	11.0	10.8	10.6	10.4	10.2	10.1	9.9
90	13.6	13.2	12.9	12.6	12.3	12.0	11.8	11.6	11.3	11.1	10.9	10.7	10.5	10.4	10.2	10.0
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